
STEVE GOODMAN
SONIC
WARFARE
SOUND, AFFECT, AND
THE ECOLOGY OF FEAR

SONIC WARFARE

Technologies of Lived Abstraction
Brian Massumi and Erin Manning, editors

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Sonic Warfare: Sound, Affect, and the Ecology of Fear, Steve Goodman, 2010

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Sound, Affect, and the Ecology of Fear

Steve Goodman

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Series Foreword

"What moves as a body, returns as the movement of thought."

Of subjectivity (in its nascent state)
Of the social (in its mutant state)
Of the environment (at the point it can be reinvented)

"A process set up anywhere reverberates everywhere."

The Technologies of Lived Abstraction book series is dedicated to work of transdisciplinary reach, inquiring critically but especially creatively into processes of subjective, social, and ethical-political emergence abroad in the world today. Thought and body, abstract and concrete, local and global, individual and collective: the works presented are not content to rest with the habitual divisions. They explore how these facets come formatively, reverberatively together, if only to form the movement by which they come again to differ.

Possible paradigms are many: autonomization, relation; emergence, complexity, process; individuation, (auto)poiesis; direct perception, embodied perception, perception-as-action; speculative pragmatism, speculative realism, radical empiricism; mediation, virtualization; ecology of practices, media ecology; technicity; micropolitics, biopolitics, ontopower. Yet there will be a common aim: to catch new thought and action dawning, at a creative crossing. Technologies of

Lived Abstraction orients to the creativity at this crossing, in virtue of which life everywhere can be considered germinally aesthetic, and the aesthetic anywhere already political.

"Concepts must be experienced. They are lived."

Erin Manning and Brian Massumi

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- *Neural entrainment*
- *Organ resonance effects*
- *Nausea*
- *Concussion and physical impact*
- *Respiration inhibition*

inaudible infrasound

unsound = sound becoming tactile

120dB

threshold of ear pain

hearing damage due to prolonged exposure

audible frequencies

unsound = nexus of not-yet-audible frequencies

- *Hypersonic modulation of audible frequencies*
- *Cavitation and heating of the body at high frequencies*
- *Neural entrainment*
- *Tissue damage if prolonged exposure*

inaudible ultrasound

unsound = sound becoming neuro-affective

0

20Hz

20kHz

frequency



We’ll come in low out of the rising sun and about a mile out, we’ll put on the music.
—General Kilgore, *Apocalypse Now*

Introduction

It's night. You're asleep, peacefully dreaming. Suddenly the ground begins to tremble. Slowly, the shaking escalates until you are thrown off balance, clinging desperately to any fixture to stay standing. The vibration moves up through your body, constricting your internal organs until it hits your chest and throat, making it impossible to breathe. At exactly the point of suffocation, the floor rips open beneath you, yawning into a gaping dark abyss. Screaming silently, you stumble and fall, skydiving into what looks like a bottomless pit. Then, without warning, your descent is curtailed by a hard surface. At the painful moment of impact, as if in anticipation, you awaken. But there is no relief, because at that precise split second, you experience an intense sound that shocks you to your very core. You look around but see no damage. Jumping out of bed, you run outside. Again you see no damage. What happened? The only thing that is clear is that you won't be able to get back to sleep because you are still resonating with the encounter.

In November 2005, a number of international newspapers reported that the Israeli air force was using sonic booms under the cover of darkness as "sound bombs" in the Gaza Strip. A sonic boom is the high-volume, deep-frequency effect of low-flying jets traveling faster than the speed of sound. Its victims likened its effect to the wall of air pressure generated by a massive explosion. They reported broken windows, ear pain, nosebleeds, anxiety attacks, sleeplessness, hypertension, and being left "shaking inside." Despite complaints from both Palestinians and Israelis, the government protested that sound bombs were "preferable

to real ones."[1] What is the aim of such attacks on civilian populations, and what new modes of power do such not-so-new methods exemplify? As with the U.S. Army's adoption of "shock-and-awe" tactics and anticipative strikes in Iraq,[2] and the screeching of diving bombers during the blitzkriegs of World War II, the objective was to weaken the morale of a civilian population by creating a climate of fear through a threat that was preferably nonlethal yet possibly as unsettling as an actual attack. Fear induced purely by sound effects, or at least in the undecidability between an actual or sonic attack, is a virtualized fear. The threat becomes autonomous from the need to back it up. And yet the sonically induced fear is no less real. The same dread of an unwanted, possible future is activated, perhaps all the more powerful for its spectral presence. Despite the rhetoric, such deployments do not necessarily attempt to deter enemy action, to ward off an undesirable future, but are as likely to prove provocative, to increase the likelihood of conflict, to precipitate that future.

Sonic Warfare: Sound, Affect, and the Ecology of Fear explores the rippling shockwaves of these kinds of deployments of sound and their impacts on the way populations feel—not just their individualized, subjective, personal emotions, but more their collective moods or affects. Specifically, a concern will be shown for environments, or ecologies,[3] in which sound contributes to an immersive atmosphere or ambience of fear and dread—where sound helps produce a *bad vibe.* This dimension of an encounter will be referred to as its *affective tone,* a term that has an obvious, but rarely explored, affinity to thinking through the way in which sound can modulate mood. Yet in the scenario above, the sonic weapon does more than merely produce anxiety. The intense vibration literally threatens not just the traumatized emotional disposition and physiology of the population, but also the very structure of the built environment.[4] So the term *affect* will be taken in this broadest possible sense to mean the potential of an entity or event to affect or be affected by another entity or event.[5] From vibes to vibrations, this is a definition that traverses mind and body, subject and object, the living and the nonliving. One way or another, it is vibration, after all, that connects every separate entity in the cosmos, organic or nonorganic.

Sonic Warfare outlines the acoustic violence of vibration and the trembling of temperaments. It sketches a map of forces with each step, constructing concepts to investigate the deployment of sound systems in the modulation of affect. The argument is based on the contention that, to date, most theoretical discussions of the resonances of sound and music cultures with relations of power, in their amnesia of vibration, have a missing dimension. This missing dimension,

and the ethico-aesthetic paradigm it beckons, will be termed the *politics of frequency.*[6] In order to map this black hole, a specifically tuned transdisciplinary methodology is required that draws from philosophy, science, fiction, aesthetics, and popular culture against the backdrop of a creeping military urbanism. By constructing this method as a nonrepresentational ontology of vibrational force, and thus the rhythmic nexus of body, technology, and sonic process, some latent affective tendencies of contemporary urban cultures in the early-twenty-first century can be made manifest. A (dis)continuum of vibrational force, a vast, disjointed, shivering surface, will be constructed that traverses police and military research into acoustic means of crowd control, the corporate deployment of sonic branding, through to the intense sonic encounters of strains of sound art and music culture.

The book is neither merely an evolutionary or historical analysis of acoustic weaponry, nor primarily a critical-aesthetic statement on the use of sonic warfare as a metaphor within contemporary music culture. Along the way, various schemes will be indicated, including experiments with infrasonic weapons, the surreal "psycho-acoustic correction" waged by both the U.S. Army in Panama City and the FBI during the Waco siege, and the Maroons whose use of the abeng horn served as a fear inducer in their guerrilla tactics against the British colonialists in Jamaica. But this list is not a comprehensive historical survey. Similarly, a total story will not be told, or a critique waged against, the militarized (and usually macho) posturing that often takes place, from rock to hip-hop, within pockets of both white and black popular music. No doubt interesting things could be said about the amplified walls of sonic intensity and feedback deployed in rock, from Hendrix, to metal through to bands like Sonic Youth and My Bloody Valentine. But this is not a book about white noise—or guitars. Equally, while some attention will be devoted to the key, inventive, sonic processes of the African diaspora, a detailed analysis of the innovative politics of black noise and militarized stance of Public Enemy and the martial arts mythologies of the Wu Tang clan are sidestepped here, despite the fact that both could fit snugly into the following pages. Moreover, more conventional representational or economic problems in the politics of black music will be detoured in favor of an engagement with the speculative aesthetic politics suggested by Afrofuturism. Ultimately, *Sonic Warfare* is concerned with the production, transmission, and mutation of affective tonality.

Similarly, this book does not aim to be an all-encompassing survey of contemporary developments in military scientific research into sound. En route,

sonic booms over the Gaza Strip, long-range acoustic devices, and musical torture in Iraq and Guantanamo Bay, directional ultrasound in supermarkets and high-frequency rat repellents deployed on teenagers will be listened out for.[7] But this is not a catalogue of these objectionable deployments.

More disclaimers. Given that the themes of the book revolve around potential sensations of sonic intensity and the moods they provoke, both controlling and creative, it may strike some readers as strange that the topic of drugs has been omitted. From ganja to hashish, from cocaine to MDMA, from LSD to ketamin to amphetamine, the nexus of drugs and sonic sensation, the narcosonic, acts as an intensifier of acoustic sensations and serves as both a sensory and informational technology of experimentation, deployed by artists, musicians, producers, dancers, and listeners to magnify, enhance, and mutate the perception of vibration.[8] The narcosonic can also function as a means to economic mobilization, with the lure of these intense experiences used as attractors to consumption within the sprawling network that now constitutes the global clubbing industry. Moreover, like the sonic, the narcotic forms part of the occulted backdrop of the military-entertainment complex, in which the modulation of affect becomes an invisible protocol of control and addiction a means to distract whole populations.[9] Yet again, to do this topic justice in both its affective and geostrategic dimensions merits a more focused project—one that would be sensitive to both the dangers and empowerments of intoxication.

The focus here will always remain slightly oblique to these research themes. While drawing from such primarily empirical projects, *Sonic Warfare* instead assumes a speculative stance. It starts from the Spinozan-influenced premise that "we don't yet know what a sonic body can do." By adopting a speculative stance, *Sonic Warfare* does not intend to be predictive, but instead investigates some real, yet often virtual, trends already active within the extended and blurred field of sonic culture. What follows therefore attempts to invent some concepts that can stay open to these unpredictable tendencies, to the potential invention of new, collective modes of sensation, perception, and movement.

By turning up the amplifier on sound's bad vibes, the evangelism of the recent sonic renaissance within the academy is countered.[10] By zooming into vibration, the boundaries of the auditory are problematized. This is a necessary starting point for a vigilant investigation of the creeping colonization of the not yet audible and the infra- and ultrasonic dimensions of unsound. While it will be suggested that the borders and interstices of sonic perception have always been under mutation, both within and without the bandwidth of human audibility, a

stronger claim will be made that the ubiquitous media of contemporary techno-affective ecologies are currently undergoing an intensification that requires an analysis that connects the sonic to other modes of military urbanism's "full-spectrum dominance."[11] *Sonic Warfare* therefore concentrates on constructing some initial concepts for a politics of frequency by interrogating the underlying vibrations, rhythms, and codes that animate this complex and invisible battlefield—a zone in which commercial, military, scientific, artistic, and popular musical interests are increasingly invested. In this way, the book maps the modes in which sonic potentials that are still very much up for grabs are captured, probed, engineered, and nurtured.

The flow of the book intentionally oscillates between dense theorization, the clarification of positions and differentiation of concepts, on the one hand, and descriptive, exemplary episodes drawn from fact and fiction, on the other. I hope this rhythm will not be too disorienting. The intention has been to present a text that opens onto its outside from several angles. The text is composed of an array of relatively short sections that can be read in sequence, from start to finish as linearly connected blocks. Each section is dated, marking the singularity of a vibrational, conceptual, musical, military, social, or technological event. In addition, these sections can as productively be accessed randomly, with each chunk potentially functioning as an autonomous module. A glossary has been provided to aid with this line of attack.

To help with navigation, here is a quick tour of the book's thematic drift. The main argument of the book is found in the tension between two critical tendencies tagged the *politics of noise* and *the politics of silence* insofar as they constitute the typical limits to a politicized discussion of the sonic. Admittedly oversimplifying a multitude of divergent positions, both of these tendencies locate the potential of sonic culture, its virtual future, in the physiologically or culturally inaudible. Again being somewhat crude, at either extreme, they often cash out pragmatically, on the one hand, in the moralized, reactionary policing of the polluted soundscape or, on the other, its supposed enhancement by all manner of cacophony. *Sonic Warfare* refuses both of these options, of acoustic ecology and a crude futurism, as arbitrary fetishizations and instead reconstructs the field along different lines.

The book opens with a discussion of the origins, parameters, and context of the concept of sonic warfare. It will be defined to encompass the physicality of vibrational force, the modulation of affective tonality, and its use in techniques of dissimulation such as camouflage and deception. The key theorists

of media technology and war, Friedrich Kittler, Paul Virilio, and, in relation to sonic media, Jacques Attali, will be outlined and extended, forcing them toward a more direct, affective confrontation with the problematics of the military-entertainment complex.[12]

A discontinuum of sonic force will be constructed, connecting examples of the modulation of affective tonality within popular and avant-garde music, cinematic sound design, and military and police deployments of acoustic tactics. Futurism responded to this discontinuum through its *art of war in the art of noise.* This artistic response has been revised, mutated, and updated by Afrofuturism, signaling how at the beginning of the twenty-first century, "futurist" approaches must adapt to the mutated temporality of contemporary modes of control, often referred to as *preemptive power*[13] or *science fiction capital.*[14]

In recent theories of sonic experience, an attempt is made to bridge the duality of concepts of the "soundscape" and "sound object" from acoustic ecology and the phenomenology of sound, respectively, through a conception of the "sonic effect." It will, however, be argued that this does not go far enough: the phenomenology of sonic effects will be transformed into the less anthropocentric *environmentality* or *ecology of vibrational affects.* This impetus is continued into questions of affective tonality in the sonic dimension of the ecology of fear. How do sonically provoked, physiological, and autonomic reactions of the body to fear in the fight, flight, and startle responses scale up into collective, mediatic mood networks? The anticipation of threat will be approached through the dynamics of sonic anticipation and surprise as models of the *activity of the future in the present,* and therefore a portal into the operative logic of fear within the emergent paradigm of preemptive power.

Drawing from philosophies of vibration and rhythm, *Sonic Warfare* then detours beneath sonic perception to construct an ontology of vibrational force as a basis for approaching the *not yet audible.* Here vibration is understood as microrhythmic oscillation. The conceptual equipment for this discussion is found in *rhythmanalysis,* an undercurrent of twentieth-century thought stretching from Brazilian philosopher Pinheiros dos Santos, via Gaston Bachelard to Henri Lefebvre. An examination of rhythmanalysis reveals conceptual tensions with influential philosophies of duration such as that of Henri Bergson. The "speculative materialism" developed by Alfred North Whitehead, it will be argued, offers a route through the deadlock between Bachelard's emphasis on the instant and Bergsonian continuity, making possible a philosophy of vibrational force based around Whitehead's concept of a nexus of experience—his aesthetic ontology

and the importance of his notion of "throbs of experience." These vibrations, and the emergence of rhythm out of noise, will be tracked from molecular to social populations via Elias Canetti's notion of the "throbbing crowd." This philosophical analysis of vibrational force will be contrasted to Gilles Deleuze and Félix Guattari's theory of the refrain, and the rhythmic analyses implicit in physical theories of turbulence. The front line of sonic warfare takes place in the sensations and resonances of the texture of vibration. An ontology of vibrational force must therefore be able to account for the plexus of analog and digitally modulated vibration, of matter and information, without the arbitrary fetishization of either. The relation between continuous analog waves and discrete digital grains is reformulated in the light of the above. Sonic warfare therefore becomes a sensual mathematics, equally an ecology of code and of vibration.

On this philosophical foundation, the affectively contagious radiation of sonic events through the networks of cybernetic capitalism will then be examined. This audio virology maps the propagational vectors of vibrational events. This involves a critical discussion of the dominant approach to cultural viruses, memetics, and the relation between sonic matter and memory. Sonic strategies of mood modulation are followed from the military-industrial origins of Muzak, the emergence of musical advertising through jingles into contemporary corporate sonic branding strategy, and the psychology of earworms and cognitive itches. The aim is to extend the ontology of vibrational force into the tactical and mnemonic context of viral capitalism. Some speculations will made regarding the acoustic design of ubiquitous, responsive, predatory, branding environments using digitally modeled, contagious, and mutating sonic phenomena in the programming of autonomous ambiences of consumption. This forces the domains of sound art, generative music, and the sonic aesthetics of artificial life into the context of a politics of frequency.

Whereas predatory branding captures and redeploys virosonic tactics to induce generic consumption, the tactical elaboration of sonic warfare in the fictions of some strains of Black Atlantic sonic futurism take the concept of the "audio virus" beyond the limitations of memetics and digital sound theory. Here, audioviruses are deployed in affective mobilization via the diasporic proliferation of sonic processes, swept along by the carrier waves of rhythm and bass science and a machinic orality. Illustrating the dissemination and abuse of military technologies into popular culture, and developing the concept of the audio virus through a discussion of the voice, the military origins of the vocoder will be tracked from a speech encryption device during World War II to

the spread of the vocodered voice into popular music. This contagious nexus of bass, rhythm, and vocal science, and their tactics of affective mobilization, will then be followed into the do-it-yourself pragmatics of sound system cultures within the developing sprawls of what Mike Davis has recently referred to as the "Planet of Slums." What vibrations are emitted when slum, ghetto, shantytown, favela, project, and housing estate rub up against hypercapital? And what kind of harbinger of urban affect do such cultures constitute within contemporary global capitalism?

The book concludes by bringing together some speculations on the *not yet heard,* or *unsound,* in the twenty-first century, mapping some immanent tendencies of the sonic body within the military-entertainment complex. The concept of unsound relates to both the peripheries of auditory perception and the unactualized nexus of rhythms and frequencies within audible bandwidths. Some suggestions will be made for the further conceptualization of sonic warfare within contemporary societies of control defined by the normalization of military urbanism and the policing of affective tonality. It is contended that, existing understandings of audiosocial power in the politics of silence and the politics of noise must be supplemented by a *politics of frequency.* The prefix "sub" will be appended to this idea of a politics of frequency. The ambivalence of the term "(sub)politics of frequency" is deliberate. To some, this will not be recognized as a politics in any conventional sense, but rather lies underneath at the mutable level of the collective tactics of affective mobilization—so a micropolitics perhaps. While this micropolitics implies a critique of the militarization of perception, such entanglements, for better or worse, are always productive, opening new ways of hearing, if only to then shut them down again. But more concern will be shown for those proactive tactics that grasp sonic processes and technologies of power and steer them elsewhere, exploiting unintended consequences of investments in control. For instance, the bracketed prefix "(sub)" is apposite, as a particular concern will be shown for cultures and practices whose sonic processes seek to intensify low-frequency vibration as a technique of affective mobilization. The production of vibrational environments that facilitate the transduction of the tensions of urban existence, transforming deeply engrained ambiences of fear or dread into other collective dispositions, serve as a model of collectivity that revolves around affective tonality, and precedes ideology.

1 1998: A Conceptual Event

Some of these sonic worlds will secede from the mainstream worlds and some will be antagonistic towards it.

—Black Audio Film Collective, *The Last Angel of History* (1997)

In an unconscious yet catalytic conceptual episode, the phrase *sonic warfare* first wormed its way into memory sometime in the late 1990s. The implantation had taken place during a video screening of the *The Last Angel of History,* produced by British artists, the Black Audio Film Collective. The video charted the coevolution of Afrofuturism:[1] the interface between the literature of black science fiction, from Samuel Delaney, Octavia Butler, and Ishmael Reed to Greg Tate and the history of Afro-diasporic electronic music, running from Sun Ra in jazz, Lee "Scratch" Perry in dub, and George Clinton in funk, right through to pioneers of Detroit techno (Juan Atkins, Derrick May, Carl Craig) and, from the U.K., jungle and drum'n'bass (A Guy Called Gerald, Goldie). Half way in, the voice of cultural critic and concept engineer Kodwo Eshun refers to the propaganda of Detroit techno's version of Public Enemy, self-proclaimed vinyl guerrillas Underground Resistance. Eshun briefly summarized their audio assault as a kind of cultural hacking against the "mediocre audiovisual" output of the "programmers." The meme of *sonic warfare* was repeated only once more in *Last Angel.*

In this cultural war, in which the colonized of the empire strike back through rhythm and sound, Afrofuturist sonic process is deployed into the networked, diasporic force field that Paul Gilroy termed the Black Atlantic.[2] On this cultural

network, the result of Euro-American colonialism, practices of slavery and forced migration from Africa, the triangle that connects Jamaica to the United States to the U.K., has proved a crucially powerful force for innovation in the history of Western popular music. The nexus of black musical expression, historical oppression, and urban dystopia has a complex history that has directly given rise to and influenced countless sonic inventions, from blues to jazz, from rhythm and blues to rock 'n' roll and from soul to funk and reggae. When this musical war becomes electronic, undergoing a cybernetic phase shift, Western populations become affectively mobilized through wave after wave of machinic dance musics, from dub to disco, from house to techno, from hip-hop to jungle, from dance hall to garage, to grime and forward. Armed with the contagious polyrhythmic matrix of the *futurhythmachine,* this sensual mathematics becomes a sonic weapon in a postcolonial war with Eurocentric culture over the vibrational body and its power to affect and be affected. So if the futurhythmachine constituted a counterculture, it was not just in the sense of a resistance to white power, but rather in the speculative engineering of "enhanced rhythm awareness," or music as nonconscious counting, to use Leibniz's phrase.[3] If Italian futurism first laid down the parameters of the modernism's *art of war in the art of noise,* Afrofuturism attempted to rewire these tactics by a transduction of the alienating experience of the Middle Passage through Afro-American, Afro-Caribbean and Black British urban machine musics. Aside from its sonic weaponry, Afrofuturism had its own propaganda machine that Eshun referred to as sonic fiction. In *More Brilliant Than the Sun,* he described sonic fiction as "frequencies fictionalized, synthesized and organized into escape routes" through "real-world environments that are already alien."[4] "Sonic fiction, phono-fictions generate a landscape extending out into possibility space . . . an engine . . . [to] people the world with audio hallucinations."[5] Sonic fiction is a subspecies of what the anomalous research collective, the Ccru, called Hyperstition, that is, the "element of effective culture that makes itself real, through fictional quantities functioning as time traveling potentials. Hyperstition operates as a coincidence intensifier."[6]

In the mid-1990s, music critic Simon Reynolds noted the preponderance of militaristic imagery within some strands of popular music, particularly those of the hallucinatory and cinematic "popular avant gardes" (he mentions specifically east coast hip-hop, hardstep jungle, and terrorcore gabba).[7] Reynolds describes these musics as producing a kinesthetic sound simulation, enacting the

dystopic megalopolis through sonic affect "in all its dread and tension." These musics, he adds, "act as mirrors to late capitalist reality, stripping away the façade of free enterprise to reveal the war of all against all: a neo-Medieval paranoia-scape of robber barons, pirate corporations, covert operations and conspiratorial cabals. In the terrordome of capitalist anarchy, the underclass can only survive by taking on the mobilisation techniques and the psychology of warfare-forming blood-brotherhoods and warrior-clans, and individually, by transforming the self into a fortress, a one-man army on perpetual alert."[8] The city becomes a war zone, "a treacherous terrain of snipers, man-traps and ambushes."

This present tense of urban dystopias, and their corollary ecologies of dread are central to *Sonic Warfare.* World systems theory, as developed by the likes of Immanuel Wallerstein, divides the world into two sectors, core and periphery, the developed and the developing world.[9] However, the pressure of reality scrambles this simplistic model into a topology of uneven development, in which the periphery is enfolded into the core, with urban ghettos constituting a kind of internal south of the global system, underdeveloped enclaves soldered into the new architectures of security and formats of megalopian sprawl so vividly depicted in Mike Davis's *City of Quartz, The Ecology of Fear* and, more recently, *The Planet of Slums.* This intersection of underdevelopment and high-tech control, amplified by racialized oppression, is the backdrop to Afrofuturism and an inspiration to its musical innovations, tangents, and lines of flight.[10] In the same way that cyberpunk fiction and cinema were foundational to discussions of the image wars of digital culture, the fictions and musical processes of black electronic musics resonate in revealing ways with the technopolitics of affective mobilization that are core to *Sonic Warfare.*

Reynolds seemed torn on the imagery of sonic warfare in ghetto musics, seduced on the one hand between the powerful affect of dread in their sonics, their antiauthoritarian stance, and their depiction of the predatory spaces of late-twentieth-century capital via their then unorthodox hallucinatory realist methodology. Yet he also seemed rightly skeptical of the paranoid, armored model of masculinity that seemed to him lay at their libidinal core. In a number of his texts, from *Blissed Out,* to *The Sex Revolts* to *Energy Flash,* Reynolds draws from Klaus Theweleit's exploration of the libidinal economy of fascist masculinity to challenge a certain legacy of "metal machine music" whose theorization he traces to a futurist lineage reaching back to Italian poet and speed-freak Filippo Tommaso Marinetti. As will be discussed later, Reynolds is also suspicious of

Afrofuturism, despite its significant divergences from both European modernism's white noise and the macho posturing of the "street." However, notwithstanding his semiotic, ideological, and psychoanalytic deconstructions of the pop manifestations of musical militarism, the concept of sonic warfare seems to compel an investigation of the material processes that accompany these sonic fictions and the seduction/compulsion and attraction/repulsion of bodies.

2001: What Is Sonic Warfare? 2

The twenty-first century started with a bang, setting the resonant frequency of fear at which the planet has been vibrating, trembling, ever since. In the echo of this bang, the software designers of anonymous peer-to-peer file-sharing networks that were mutating the global music industry were drafted in as "precogs" of the actions of viral terror networks. At an irregular rhythm, audio and audiovisual cassettes would turn up on the desks of Arab media networks, relaying jihadist communiqués. Seeking to verify these rare terror clues, Western security agencies would subject these sound bytes to audio forensic analysis, a vocal parallel to fingerprint analysis, digitally hunting down transitions between phonemes, the patterns of glitches that function as unique voice identifiers. But irrelevant of truth value, these pulsed sonic signals triggered real, incorporeal transformations within the ecology of fear.

These specifics are new, but the sonic dimensions of conflict are ancient. From Hitler's use of the loudspeaker as a mechanism for affective mobilization during World War II, through to bin Laden's audiotaped messages, the techniques of sonic warfare have now percolated into the everyday. But how the illusive decentralized networks of contemporary asymmetric warfare resonate within the decentralized networks of sonic culture remains a topic of marked neglect.

How are sound systems (consisting of bodies, technologies, and acoustic vibrations, all in rhythmic sympathy) deployed in a war of mood, sensation, and information? And what demilitarized zones can they produce, laboratories for

affect engineering and the exorcism of dread, occupying the precarious virtual threshold between dance and violence? What, in other words, is sonic warfare?

It is always more useful to ask what something can do, its potential, rather than what it is, its essence. What then is the power of this phrase *sonic warfare?* Can it conceptually rewire the microsound of politics and the micropolitics of sound? What cultural tensions does it amplify? In what follows, an open sketch will be made in response to these questions, identifying a discontinuum of deployments of sound system concepts, cultures, and technologies across the fault lines of contemporary culture.[1] At the dawn of a new millennium and in the midst of the cybernetic phase of war and cultural machines, an investigation of sonic warfare reveals some intriguing patterns regarding emergent modes of perception, collectivity, and cultural conflict in the twenty-first century.

Throughout history, often imperceptibly, the audiosphere has been subject to militarization. A notion of sonic warfare lies at the heart of modern experimental music and takes us back to the apex of the sonic avant-garde, to Luigi Russolo's Futurist manifesto for music, *The Art of Noises,* which glorified explosions, rifle fire, and the dissonance of industrial machinery as an assault on the deadened sensorium of classical music and bourgeois aesthetics. The futurist



art of war in the art of noise framed cultural innovation in the field of music as a sensory war in which the stakes were no less than the distribution and hierarchical stratification of the nervous system. A crystallization of the belligerent libidinal field of the early twentieth century, futurism processed the schizzed and shell-shocked psyche of the battlefield, seeking a new synthesis—one claiming to break with the organic wholeness of the past in favor of a technical enhancement (and usually, for Filippo Tommaso Marinetti, a phallic extension), a rewiring of the body and its sonic sensations.

Theorists such as Jacques Attali and Paul Virilio repeatedly return to the early-twentieth-century futurist conceptual experiments such as those of Russolo and Marinetti's poetics of shell shock, to explore the intersection of war machines and media machines. Fusing together the concepts of noise, war, and speed with



the technosensations of the industrial age, the futurists launched what they considered to be an assault on the harmonic order. In his 1913 manifesto, Russolo noted that musical sound was too limited in "its variety of timbres. The most complicated orchestras can be reduced to four or five classes of instruments in different timbres of sound: bowed instruments, brass, woodwinds, and percussion. Modern music flounders with this tiny circle, vainly striving to create new

varieties of timbre. We must break out of this limited circle of sounds and conquer the infinite variety of noise-sounds."[2]

For both Russolo and Marinetti, the battlefield is glorified as a ballistic aerodynamic space in which the eye dismounts the pyramid of the senses, leaving sensory navigation in the domain of the haptic. As Russolo puts it,

> In modern warfare, mechanical and metallic, the element of sight is almost zero. The sense, the significance, and the expressiveness of noise, however are infinite. . . . From noise, the different calibres of grenades and shrapnels can be known even before they explode. Noise enables us to discern a marching patrol in deepest darkness, even to judging the number of men that compose it. From the intensity of rifle fire, the number of defenders of a given position can be determined. There is no movement or activity that is not revealed by noise.[3]

In this legacy of Italian futurism,[4] the intersection of sound machines and war machines as a field of cultural analysis has been dominated by this elusive concept of "noise."[5] Usually noise, or disorganized sound, is conceived as a weapon, a code bomb launched by those practitioner-theorists angry at the complacency or conservativeness of a certain hierarchal stratification of audiosocial matter. Noise, from Russolo to Attali, is therefore understood as intrinsically radical, as that which lies outside music, that which threatens music from without, rejuvenating it, giving it the energy to do anything new. Following the futurists, noise, for Attali, is understood as a cultural weapon that attacks musical codes and networks in an audiosocial warfare of aesthetics and economics. Attali notes that before its development in information theory, "noise had always been experienced as destruction, disorder, dirt, pollution, an aggression against the code-structuring messages. In all cultures, it has been associated with the idea of the weapon, blasphemy, plague," and other agents of destruction.[6]

From futurism in the early twentieth century onward, noise has been a key preoccupation of the modernist sonic avant-garde. Often under a conceptual alliance with "chaos," noise ties together the "Art of Noise" to John Cage's experiments with any sound whatever, chance, and the I-Ching, to free jazz and Japanese noise terrorism, through to the recent preoccupations with digital glitches, process aesthetics, and their current manifestations in generative and algorithmic music and microsound. Yet despite the radical rhetoric, many of these avant-gardist formulations of noise as a weapon in a war of perception, a war whose battlefield is the body (its sensations, reflexes, and habitual ticks), fail time and time again to impress. With many of these instances, as Gilles Deleuze

and Felix Guattari point out, "All one has left is a resonance chamber well on the way to forming a black hole."[7] In an already radically schizophonic[8] soundscape of the early twentieth century, Louise Varese had decried the noise tactics of the Italian futurists for having "slavishly reproduced only what is commonplace and boring in the bustle of our daily lives."[9] Now, in the twenty-first century of ubiquitous schizophonia, an alternative formulation is required that discards those exhausted uses and practices that result from the paradoxical "genrefication" of noise.

In his recent *Bring the Noise,* Simon Reynolds notes how the "noise effect" has made a recent resurgence, particularly through "all those overlapping sub-styles of squall and atonal abstraction that come out of industrial music, free jazz, musique concrete and sound art. The concept of 'noise' has made a big comeback in recent years . . . the irritating end of it is all those artist aiming for ye old 'shock effect,' their pure noise laden with content of tediously 'transgressive' nature (all the old clichéd faves of vileness and violation: serial murder, neo-Nazis, yawn . . .). The blindingly obvious fact is that no one shockable is within earshot; there's no disruption or challenge in these scenes, because they're screeching to the converted."[10] If anything should be salvaged here, it is that noise is always a relational concept, and Reynolds persuasively argues that the concept is actually least radical in the "ears-are-wounds sense." Instead, for Reynolds, noise stands for the reservoir of invention in those "popular but un-pop sounds [that] have echoed the trajectory of twentieth-century avant-garde classical music, which advanced through incorporating non-musical sounds, aestheticizing mistakes, deploying randomness, and asserting the percussive and the textural over the melodic and harmonic."[11]

In addition to pointing to the problems of futurism's orientation to temporality in a postcyberpunk epoch, of leaving the past behind to speed off into the future, the concept of noise will be steered elsewhere, investigating what happens when it is conceived not as an end in itself but instead as a field of potential. At the same time, it will prove useful to retain and sharpen the futurist concern with acoustic warfare, whereby sonic effects serve as cultural weapons. Yet where possible, a detour will be taken around the celebration of entropy in much discourse surrounding noise, instead staying alert to the micromovements lurking within. By shunting the problem of noise onto one of the emergence of rhythm from noise, the power of a vibrational encounter to affectively mobilize comes into clearer focus.

As a backdrop to this resurgence of the concept of noise, the "sonic" has become an increasingly fashionable terrain in recent years, coinciding with the explosion of electronic music culture in the 1980s and 1990s and its intensification of this futurist and Cagean openness to nonmusical sound and a related resurgence of interest in the potential of postliterate sensory recombinations by attacks on the dominant ocularcentric models of Western philosophy.[12] Conceptually, the limitations of many cultural studies approaches have been exposed with this expanded remit from music culture to sonic culture. Some attempts have refocused phenomenologically around the concept of audition.[13] However, probing deeper than the merely auditory, the vibratory materialism developed here focuses, before human hearing, on the primacy of the synesthetic.[14] The sonic will be emphasized in its sensory relation, in its intermodality, as rhythmic vibration, in excess and autonomous from the presence of a human, phenomenological subject or auditor. Any definition of sonic culture must synesthetically take into account that which exceeds unisensory perception, that which impresses on but is exterior to the sonic. Sonic warfare is therefore as much about the logistics of imperception (unsound) as it is perception. The bandwidth of human audibility is a fold on the vibratory continuum of matter. With reference to military research into acoustic weaponry, this molecular backdrop will be mapped as a vibratory field into which the audible is implicated. On the frequency spectrum, bounding the thresholds of perceptible sound (above 20 hertz and below 20 kilohertz), where sonic perception becomes intermodal or defunct, lies infrasonic and ultrasonic wave phenomenon. The narrowband channel of the audible plunges into the murky depths of low-frequency infrasound and subbass, or constricts into the piercing high frequencies of ultrasound. Sonic culture, thus situated, renders the urban audiosocial as a system of speeds and channels, dense pressure pockets, vortices of attraction, basins of acoustic immersion and abrasion, vibratory and turbulent: a whole cartography of sonic force.

When Attali asked us to probe into the "fundamental noise" that scrambles contemporary codes of communication, he was implicitly signaling the centrality of affect. It is at a subsignifying level, at the level of intensity where a "crossing of semantic wires" occurs, that a map of affective tonality can be constructed. *Sonic Warfare* forces an engagement with theories of affect and the imperceptible and sidesteps those preoccupations of cultural studies' critical musicological approaches that tend to limit discussion around issues of representation, identity,

and cultural meaning.[15] The linguistic, textualist, and social-constructivist perspectives that dominated cultural theory in the 1980s and 1990s are of little use to us here. Even Attali, against the critical musicological obsession with the meaning or signification of sound, points out that music itself "cannot be equated with a language . . . [because it] never has a stable reference to a code of the linguistic type." If it must be construed as a language, then it is one that abandons narrative; it is not myth coded in sounds instead of words, but rather "language without meaning."[16] Affect comes not as either a supplement or a replacement to the preoccupations of cultural theories of representation, but rather as an approach that inserts itself ontologically prior to such approaches, thereby examining the very conditions of possibility for a sonic materialism and the ethico-aesthetic paradigm it would entail.



As opposed to sound as text, the dimension explored here is that of sound as force. *Sonic warfare* then, is the use of force, *both seductive and violent, abstract and physical,* via a range of acoustic machines (biotechnical, social, cultural, artistic, conceptual), to modulate the physical, affective, and libidinal dynamics of populations, of bodies, of crowds. Before the activation of causal or semantic, that is, cognitive listening,[17] the sonic is a phenomenon of contact and displays, through an array of autonomic responses, a whole spectrum of affective powers. Sound has a seductive power to caress the skin, to immerse, to sooth, beckon, and heal, to modulate brain waves and massage the release of certain hormones within the body. Discussion of the physiological affects of sonic weaponry has usually centered on intensity (acoustic power), the ultrasonic or the infrasonic; the very loud, the very high pitched, and the very low pitched. At high sound pressure levels, the ear is directly damaged. Need we be reminded that noise, like anything else that touches you, can be a source of both pleasure and pain and that "beyond a certain limit, it becomes an immaterial weapon of death. The ear, which transforms vibration into electric impulses addressed to the brain, can be damaged, and even destroyed, when the frequency of a sound exceeds 20,000 hertz, or when its intensity exceeds 80 decibels. Diminished intellectual capacity, accelerated respiration and heartbeat, hypertension, slowed digestion, neurosis, altered diction: these are the consequences of excessive sound in the environment."[18] Curtis Roads notes that "the force of an explosion, for example, is an intense acoustic shock wave" and calls these potent frequencies and amplitudes "perisonic intensities (from the Latin periculus meaning 'dangerous')."[19]





A different conception of sonic warfare is perhaps suggested, in prototype form, by Gilles Deleuze and Felix Guattari in *A Thousand Plateaus.* Such a con-

ception deviates from an intrinsic relation between noise and sonic violence suggested from futurism through to Attali and beyond, and instead implies a kind of guerrilla sonics out of which any militarized investment would be constructed only through capture. Rather than the conventional monotonous artistic alliance between noise and destruction in a transgressive attempt to shock, noise instead becomes a vibrational field of rhythmic potential. A "sonic war machine" along these lines would be defined by its rhythmic consistency, would not take violence or noise as its primary object, but rather would concentrate its forces on affective mobilization and contagion. Its politics of frequency would entail the way in which vibrational force would be captured, monopolized, and redeployed.

This range of conceptions may initially be outlined in terms of a continuum. At opposite poles of the sonic warfare continuum then, two basic tendencies could be identified, two poles of this continuum of sonic force, perhaps two inverse modes or tactical tendencies. One is militarized, and the other engages in a warfare with an altogether different set of priorities.[20] In abstract terms, these extensive and intensive tendencies of audiosocial radiation can also be usefully described as, on the one hand, centrifugal, efferent, repulsive, producing a movement that spirals out from source, and on the other hand, a centripetal, afferent, attractional power producing a movement that spirals in toward a source. Clearly one tactical deployment of sound is subordinated to the strategic aim of crowd dispersal, to the dissipation of a collective energy, to repulsion and dissolution of clusters, and to the individualization of the movement of bodies. On the other side, we have a tactical deployment whose objective is that of intensification, to the heightening of collective sensation, an attractive, almost magnetic, or vortical force, a force that sucks bodies in toward its source. This dynamics may be thought meteorologically in terms of heat and pressure, as in "the eye of the storm," or in terms of the turbulence of fluid mechanics: a power to generate a rhythmic rotation, intensification, and collective individuation (to render the crowd as a body in its own right). In this instance, the aim of mobilizing bodies extensively is accompanied and perhaps overridden by the primary objective of the intensive mobilization of affect.



Crucially, between these two coexistent tendencies, the attractive and repulsive power of sonic force, the issue is obviously not simply one of good or bad. Rather, their ambivalence indicates some of the emergent features central to the strategies and tactics of control within contemporary capitalism. The relation between these two tendencies of sonic force must be thought through very



carefully. Not only must the extensive tendencies of "sonic war machines" be examined—their abilities to make bodies move—but also the range of intensive tendencies involved in the deployment of sound system technologies—their modulation of affective tone. While the centrifugal, repulsive deployment of sound machines (cultural, not just technical) can appear to be the preoccupation of military and police functions, it would be futile to naively celebrate the centripetal attractive power of the sound system. The problem of sonic warfare, strategic, tactical, and logistical, is clearly a complex one. In many compelling sonic cultural situations, we have a mixture of both, where, for example, sound is so overwhelming that we feel forced to take leave, but instead, resisting that initial gut feeling, the autonomic or involuntary reaction to take flight, we stay to enjoy. Conversely, a sonic fascism may occupy both poles of this continuum.

To help clarify this analysis, key insights on sonic media extracted from philosophy, fiction, cultural theory, popular music, and the intersection of science and art will be examined against the backdrop of military urbanism in order to identify the new sensations mobilizing an emergent generation of practitioners and theorists. Much speculation can also be found in conspiracy theory, which is only natural when research related to the defense industry is concerned. These sonic fictions and urban myths can form a starting point for a more careful philosophical investigation. For, in addition to the paranoid sensationalism that enlivens these often spurious accounts, they remind us that the sonic (and unsonic) body is always poised precariously in a processual disequilibrium with the acoustic environment, and that even minute perturbations of this environment can set in motion resonant events and generate and provoke unforeseen cultural mutation. Moreover, if Jacques Attali is right, then in addition to the intense perceptual encounters sound system cultures can produce through music and noise, they may also emit transposable and prophetic diagrams of sociality, equipped with novel armories of affects, percepts, and concepts.

As already noted, *Sonic Warfare* will not attempt to be comprehensive about the full range of sound-affect conjunctions but will instead concentrate on the strange nexus of sound and fear. If Brian Massumi was correct when he argued in the early 1990s that fear was our overriding affective syndrome, the "inherence in the body of the multi-causal matrix . . . recognizable as late capitalist human existence,"[21] what critical urbanist Mike Davis has dubbed the *ecology of fear,* then analysis of these sensory tactics of affective mobilization and contagion will only become more pressing. The sonic is particularly attuned to examining one strand of this ecology of fear: dread.

Sonic experience will be placed in the context of a resonant cosmos that cuts across the duality of physical and emotional processes. The point of constructing this ontology of vibrational force is not to naturalize cultural phenomena in order to deny any possible tactical intervention, nor to suggest nature as a force of spontaneous vitality and therefore emancipatory power. Rather, the resort to a basic, indifferent vibrational plane exposes the inhuman entities that haunt the nature-culture continuum as it transects the networked affective battlefields of twenty-first-century geostrategy. The production of the ecology of fear is intensified under the shadow of "shock and awe." An investigation into asymmetric attacks and deployments waged on the affective status quo within the microcosm of the sonic might have a much broader significance.

Finally, the sonic forms a portal into the invisible, resonant pressures that impress on emergent cyberspaces with all of their problematics, from virtuality to piracy. With increased online bandwidth, sound has attained a more central role in the polymedia environment of contemporary culture, unleashing unpredictable technoeconomic transformations resonating throughout global music culture. *Sonic Warfare* therefore also offers some insights into the economy of attention of contemporary capitalism.

2400–1400 B.C.: Project Jericho

3

In Project Jericho, a short radiophonic piece created by the dramatist Gregory Whitehead, a hyperstitional research institute, the Jericho Institute, and its research program is fabulated to embody the recent history of sonic warfare.[1] Whitehead's work versioned the biblical myth of the Walls of Jericho (Joshua 6:5) in which Joshua is spearheading an attack on the city. Outside the walls of the city, God instructs Joshua to march around it once each day for six days in total silence. On the seventh day, he has to march around seven times. Then before the Ark, seven priests blew on seven trumpets made from ram's horns, and, as if by magic, like a sonic bulldozer, the walls came crashing down. In Project Jericho, the "living spirit" of the institute, under the name of Colonel Walter Manley, is an unnerving fusion of George W. Bush and Kurtz from *Apocalypse Now.* With helicopters buzzing around a filtered audio communiqué, Manley relates, in a parody of the recent wave of U.S. military strategy documents and press releases, how "we are at the dawn of a new era of military history marked by the dominance of a weapon system based on the most powerful sound in the universe." Manley outlines that the institute's brief is to research and use

> sound creatively in the production of nonlethal weapons designed to save lives by changing the hearts and minds of our adversaries. During the Vietnam war, we still confused sonic power with high volume, for example, in the so called Urban Funk Campaign where we mounted supersized oscillators on top of attack helicopters and blasted Victor Charlie with heavy metal at 120dB. We called that weapon the Curdler and it was a very

primitive system, but we also used high frequency nighttime wailing sound in a weapon we called the "Wandering Ghost," intended to spook the Viet Cong by playing on certain Buddhist beliefs and that weapon was a big step forward because we came to realize that there is no sound more powerful than the one that conquers your true heart with deep vibrations. . . . Ultimately what we are talking about is a weapon that uses harmonic infrasound amplified by the power of Evangelical Christian faith to summon and deploy a voice that sounds like it comes from right inside your head, but also sounds like it is coming from everywhere else. A voice that comes from everywhere and no where, from everyone and no one, and when you hear it, you will obey no matter what it says because the real weapon that brought down the walls of Jericho was the voice of God. . . . At the Jericho Institute, we like to think of America's deep and abiding Christian faith as one of our most strategically potent natural resources. We have extensive prayer networks throughout the Bible belt and elsewhere and our objective is to synchronize the latent vibrational power of these faith networks with an infrasonic sound that formally replicates the voice of God in terms of its frequency range and overall acoustic envelop. We call this process, "charging the airspace," a process that resembles rubbing on the magic bottle until the genie comes out. Ladies and gentlemen, God is there to hear our prayer. Now it is true that the previous assumption was that God had to make the first move from an acoustical perspective as in for example when he says "let there be light" but we believe that if we can create the right acoustic and provide the appropriate vibrational context, it will be possible to actually produce the voice of God in a faith based conflict whereby "God is on our side" . . . [cut to low flying helicopter . . .].

Whitehead's Project Jericho neatly wraps the real and fictitious history of sonic warfare into a hyperstitional package. And it is an ominous package, a potential projectile laser-guided by the convergence of evangelical certainty and neoliberal preemption. It taps into an episodic history consisting of the hazy stories of secret military research entangled by webs of fiction, myth, and dark science. Rummaging around for something concrete, you happen upon dead end after dead end of conspiracy theory, inventions without patents, and rumors without origin. Much conjecture, for example, points to eccentric research carried out in Nazi Germany. One bizarre device was said to have been spawned by an Austrian researcher by the name of Dr. Zippermeyer. As a reaction to relentless Allied air assault of Germany, he was alleged to have experimented with both wind and sound as potential antiaircraft weapons. His *Windkanone,* or "Whirlwind Cannon," was supposed to have produced artificial whirlwinds "by generating an explosion in a combustion chamber and directing them through specially designed nozzles at their target. Experiments with a small cannon supposedly shattered planks at 200 yards (183m) range, and a full size one was built."[2]

From cartography (via sonar) and signaletics (deployed in acoustic detection), from psyops (psychological operations) to the current fashion in nonlethal "soft" weaponry for crowd control (the violence of sensation),[3] this logistics of sound perception mobilizes a range of affects traversing the psychophysiological and an invisible history of the research and development of tactics of amplitude and tactics of frequency. It brings into the field of power the dimension of unsound, of frequencies just outside the periphery of human audibility, infrasound and ultrasound, as well as the nonstandard use of popular music, not as a source of pleasure, but for irritation, manipulation, pain,[4] and torture.[5] No doubt, empirical and in-depth studies are lacking and desperately needed on these diverse deployments. However, as our primary aim lies elsewhere, a brief overview will have to suffice. Even this cursory glance, however, provides a counterpoint to popular music studies at their most banal, with their dismal celebrations of consumerism and interminable excuses for mediocrity.

In the mutating logistics of sonic perception, a general tendency in both research and deployments can be detected. The historical drift in the technical deployment of sonic force is marked by a number of parallel phase transitions: from the violence of high amplitude to inaudible or silent frequencies, from discipline and punishment to subtle control through modulation of affective tonality,[6] from forcing behavior to the distribution of "self-control," from the messy and unmanageable to the highly directional and targetable, from exceptional deployments to ubiquitous fields or enclaves fortressed by sonic walls, and from music as pleasure to music as irritant. Importantly, this is not a successive history of stages; these modalities of sonic power coexist with each other, often literally in the battlefield. Moreover, precursors exist decades before they snugly align with the current modalities of power. Instead, sociotechnical inventions and refinements layer up—so, for example, while there is a drift toward more subliminal effects, the perfection of sonic violence with new directional technologies means its use has never before been so practical. At the same time, certain events mark qualitative shifts in this history, beyond which everything changes. I suggest later that directional ultrasound perhaps marks a phase shift in the way acoustic space is understood in relation to the war machine. Finally, the specifics of each deployment add new inflections, topographic and strategic—from the jungle warfare of Vietnam, to the urban desert warfare of the Middle East, to the dispersion of rioters, to the most trivial "antisocial" behavior, right through to the enhancement of affinities to consumption—that relate war and



sound in different ways. The ubiquity of media and the increasing importance of asymmetric urban warfare together have meant that any tactics whose impact wounds are invisible and nonlethal offers methods less likely to trigger waves of revulsion through the networked consciences of global media.



Early attempts to develop sonic weapons focused on the physicality of low-frequency sound and the fact that it dissolves completely into tactile vibration at frequencies around 20 hertz. Below this threshold lies the field of infrasound. Infrasonic phenomena, unlike ultrasound, maintain their power as they pass through a range of media. Surveying the limited literature on these semiaudible wave phenomena, one finds Virilio's informational logistics of deception in operation. Research uncovers an array of conspiracy theories shrouding programs of military research into the battlefield operation of infrasonic weaponry or police experiments within crowd control situations—a war of vibration to dampen the insurgent potential of the street. The Internet, in particular, is awash with conspiracy theories on "black research." According to this murky body of knowledge, military uptake of infrasound technologies stretches back at least to World War I, during which detectors were used to locate enemy gun positions. Resultant pathological effects in the middle ear also began to be discovered in military personnel during the two world wars in soldiers working with machines emitting low-frequency vibrations. Moreover, it has been noted that certain infrasonic frequencies plug straight into the algorithms of the brain and nervous system. Frequencies of 7 hertz, for example, coincide with theta rhythms, thought to induce moods of fear and anger.[7]



A key hyperstitional[8] figure, who appears as a refrain in the underground literature on infrasonic acoustic weaponry is French robotics researcher Vladimir Gavreau,[9] allegedly head of the Electroacoustics and Automation Laboratories of the Centre de la Recherche Scientifique during the 1960s. Gavreau and his team, we are told, performed some pioneering experiments into the anomaly of infrasonic waves that were directional in "contradiction of a universally accepted acoustic law which states that low frequency sounds emitted by a relatively small source propagate in all directions."[10] After accidentally experiencing nausea in his lab with his research team (owing to unintended vibrations leaking from industrial machinery), Gavreau became obsessed by harnessing infrasonic resonance to design sonic weapons (usually in the form of huge pipe devices). After another experiment, caught in the vibratory "envelope of death," Gavreau and team allegedly suffered sustained internal spasms as their organs hit critical

resonance frequencies. It was these strange physiological anomalies, generated by inaudible vibrations, that inspired his research into infrasonic acoustic guns. The key notion was that directional inaudible sound at certain resonant frequencies "acting directly on the body" could produce "intense friction between internal organs, resulting in a severe irritation of nerve endings."[11] Some versions of the Gavreau story even suggested that one of the team had his insides pulped, and reinforced tank armor was ripped open by the infrasound Levasseur whistle. The team set out developing a number of applications of their findings, including acoustic guns, acoustic lasers, and acoustic "rectifiers," all based around infrasonic frequencies.

As the Gavreau episode illustrates, to have a future, sonic weapons would have to be less messy. After the 1960s, the blunt violence of infrasound research can also be found in the panic-inducing violence of high-volume frequencies. Manley makes reference to the Urban Funk Campaign (UFC) and Wandering Soul, the U.S. "audio harassment" psyops campaigns in Vietnam and Laos during the early 1970s that inspired General Kilgore's infamous Wagnerian fly-bys in Coppola's *Apocalypse Now.* The UFC experimented with tactics of amplitude and frequency. Audible and inaudible frequencies were pumped into the jungle at the Vietcong at high-volume levels (120 decibels and higher). The objective, through attacking with sound instead of munitions (of course, in actuality, it was sound as well as bombs), was to weaken the resolve of the Vietnamese guerrilla fighters and make them come out of hiding and surrender. The UFC deployed helicopter-mounted devices known as sound curdler systems. The Curdler, or "People Repeller," was an oscillator that could deafen at short range. When used with a public address system and a 350 watt sound amplifier, it was possible to direct intelligible speech to a range of 2.5 miles.[12] The Curdler was also capable of unleashing siren frequencies of between 500 and 5,000 hertz and of inducing panic. With more powerful amplifiers, the device made it possible to construct a sonic pyramid up to 3,500 meters in height, bathing the jungle canopy with an invisible and mobile architecture.

As the unhinged Manley suggests, this was not just about a tactics of amplitude. At night, its effectiveness was intensified, acquiring an enhanced power to tap into superstitious belief systems. The Curdler produced the "voodoo effects" of Wandering Soul[13] (or Wandering Ghost, as Manley calls it), in which haunting sounds said to represent the souls of the dead were played in order to perturb the superstitious snipers, who, while recognizing the artificial source of

the wailing voices, could not help but dread that what they were hearing was a premonition of their own postdeath dislocated soul. As journalist John Pilger reported in his book *Heroes,*

> The 1st Air Cavalry Psy-Ops (Psychological Warfare) officer was a captain, although he might have been Sergeant Bilko; he wore black horn-rimmed glasses and a banana grin. He was a stereo-and-speakers buff and what he loved to do was to fly in a helicopter low over the jungle and play his tapes to the enemy. His favorite tape was called "Wandering Soul," and as we lifted out of Snuffy he explained, "what we're doing today is psyching out the enemy. And that's where Wandering Soul comes in. Now you've got to understand the Vietnamese way of life to realize the power behind Wandering Soul. You see, the Vietnamese people worship their ancestors and they take a lot of notice of the spirits and stuff like that. Well, what we're going to do here is broadcast the voices of the ancestors—you know, ghosts which we've simulated in our studios. These ghosts, these ancestors, are going to tell the Vietcong to stop messing with the people's right to live freely, or the people are going to disown them."
>
> The helicopter dropped to within twenty feet of the trees. The Psy-Ops captain threw a switch and a voice reverberated from two loudspeakers attached to the machine-gun mounting. While the voice hissed and hooted, a sergeant hurled out handfuls of leaflets which made the same threats in writing.[14]

Many reports retell its use by the Sixth Psy-Op Battalion and various navy units. Other accounts, for example, by a U.S. helicopter pilot, complained that instead of winning over hearts and minds, it always immediately drew enemy fire, making the Vietcong soldiers vulnerable to attack as opposed to encouraging them to surrender or defect peacefully.[15]

Although its existence was denied by the British Ministry of Defence, the UFC was also supposed to have inspired a device called the Squawk Box, used during the troubles in North Ireland for crowd control. In an article in the *New Scientist* in 1973, a report was published on the alleged effects of "nonviolent" crowd dispersal weapons using ultrasound. The squawk box was contained in a three-foot cube mounted on Land Rovers and was said to emit two ultrasonic frequencies that together produced a third infrasonic frequency that was intolerable to the human ear, producing giddiness, nausea, or fainting, or merely a "spooky" psychological effect. The report noted diplomatically, "Most people are intensely annoyed by the device and have a compelling wish to be somewhere else."[16]

In the late 1980s and early 1990s, new techniques of sonic coercion entered the fray. Between December 21 and 31, 1989, U.S. troops in Panama City directed loudspeakers at former CIA employee Manuel Noriega, who had barricaded himself in the Vatican embassy. They bombarded him with loud rock and pop

music[17] and on-message songs such as Martha and the Vandellas' "Nowhere to Run" and "You're No Good" by Linda Rondstadt in order to either irritate him or prevent him from sleeping. Militarized pop got even more avant-garde during the Waco siege of 1993. The FBI engaged in "acoustic psycho-correction," playing high-volume music blended with sound effects into the compound of the Branch Davidians led by David Koresh with a playlist that was accompanied by bagpipes, screeching seagulls, dying rabbits, sirens, dentist drills, and Buddhist chants. One story maintains that silent subliminal tapes were also used along with music, including the tale of one Guantanamo detainee who was left in an empty room with a boom box playing a variety of classic rock tracks, which John Ronson suggests were embedded with subliminal messages to nudge him toward revealing all he knew about al Qaeda.[18] Other torture allegations against the U.S. Army, for example from Falluja in Iraq, tell of the bizarre subjection of captives under interrogation with musical torture.[19]

Alongside these allegations from the U.S. war on terror, the episodic history of sonic warfare has recently taken on even more prescience due to the widely covered uses of acoustic weaponry by both the U.S. and Israeli armies. In February 2004, for example, the American Technology Corporation secured a $1 million deal to provide long-range acoustic devices (LRADs) to the U.S. Marine Corps in Iraq. These LRADs are said to provide "an effective less-than-lethal tool to communicate, affect behavior, and support lethal rules of engagement."[20] They involve targeted high-frequency beams of sound about 2,100 to 3,100 hertz of up to 150 decibels within a range of 100 yards.[21] Their primary function has been as a crowd dispersal tool, and they were also used in the aftermath of Hurricane Katrina to repel looters.

Returning again to Colonel Manley, pumped up with his zealous enthusiasm, he seemed excited by the prospect of deploying his theoacoustic weaponry, with Whitehead making parallels to widely reported tests of sonic crowd control near Jericho early in the summer of 2005,on the eve of the evacuation of settlers from the contested West Bank territory. The Israeli army issued a press release about its contingency plans for dealing with turbulence among Israeli and Palestinian populations generated by this demographic transition. The Israeli Defense Force dubbed their new "nonlethal" sound weapon "The Scream": "Protestors covered their ears and grabbed their heads, overcome by dizziness and nausea, after the vehicle-mounted device began sending out bursts of audible, but not loud, sound at intervals of about 10 seconds. An Associated Press photographer at the scene said that even after he covered his ears, he continued to hear the

sound ringing in his head."[22] The device, a military official noted, targeted a specific frequency toward the inner ear. Throwing more uncertainty into this foggy history of research into acoustic weaponry, some even suggested that this was perhaps the first time such a device had been deployed out of the lab and in the field, despite the fact that one nameless official admitted that the proper tests on long-term auditory damage due to prolonged exposure to the frequencies had not yet been conducted. It was clearly such recent instances that inspired Whitehead's Project Jericho piece.



Aside from military and police deployments, research into ultrasound in the field of commerce realizes the notions of science fiction. In Steven Spielberg's adaptation of Philip K. Dick's *Minority Report,* personalized branding messages are beamed at passing consumers, identified by retinal scans. What kind of technologies would push these signals at individual bodies in the crowded spaces of hypercapital? One application of the highly directional qualities of ultrasound currently being researched involves a signal carried by a very focused beam. These "audio spotlights," or "holosonics" devices, facilitated the microlocational targeting of audio advertising, part of the arsenal of insidious sonic branding strategies in which brands become woven into the fabric of immersive, interactive, predatory environments. These carrier mechanisms, increasingly deployed in sound art installations and undergoing research and development for theater surround-sound systems, have been dubbed sonic bullets or lasers: when you pass through the beam, you hear the sound as if a mere auditory hallucination. One step right or left, and you vacate the zone of audition. Crank up the pressure, and that targeted beam becomes a hypersonic weapon. Also operating with high-frequency sound, this time as an irritant as opposed to a directional beam, is a device referred to as the Mosquito. Operating just at the edge of the threshold of audibility, between 15 to 20 kilohertz, Mosquitoes, originally aimed at repelling rodents, were recently repurposed on teenagers in the U.K.

Despite these recent news reports of confirmed deployments, a penumbra of uncertainty will always exist around military-police security research. Deception, after all, as Sun Tzu tells us, is the most potent weapon of war. What then, should be made of this confusing mesh of data, rumor, defense industry press releases, pop mythology, and news reports surrounding the concept of sonic warfare? Clearly there are big differences between biblical stories, occult research into infrasound, and the redeployment of rodent-repellent ultrasound devices on teenagers on the streets of the U.K.

A rare voice of scientific sobriety within a jungle of hearsay and rumor is the figure of German researcher Jurgen Altmann, who, at the 1999 Acoustical Society of America conference in Berlin,[23] presented a paper questioning the practicality of sonic weapons. In his report Altmann attempts to cut through the marketing hype of military journals and arms manufacturers concerning nonlethal acoustic weaponry. In one summary of his findings, he asks sarcastically, "How can one turn a threatening gunman into a retching bundle of nerves, suffering simultaneously from bowel spasms and a loss of courage before surrendering to the police? Simply use infrasound on him."[24] Altmann goes on to discredit the claims of the military press regarding the potential of sonic weaponry. He surveyed the scientific data on sound sources (sirens, whistles, and explosions), strength of acoustic propagation (beam widening and absorption), the hearing and nonauditory effects on humans, and the danger of potential damage. Altmann's general conclusions were that acoustic weaponry tended to be rather cumbersome and posed the most dangerous threat to the auditory system, which is rather easy to defend against, instead of the somewhat elusive and extravagant incapacitating physiological effects claimed in defense industry press releases and conspiracy theories.

However, Altmann's scientific debunking does not render useless the concept of sonic warfare. The wave of LRAD and holosonic devices that has emerged in the early twenty-first century seems to be more effective than the weapons he surveyed in 1999. While it was true that experiments with infrasonics were marked by a catalogue of mishaps and general unmanageability, high-frequency beams of ultrasound have proved much easier to target. Moreover, a scientific survey such as Altmann's in fact compels that which it excludes: an analysis that can account for the viral infiltration, the affective contagion, and the distribution of the war machine into the quotidian foldings of the sonic body, its sensations, rhythms, fictions, and desires.

Despite the welcome note of extreme caution that Altmann's "voice of reason" inflicts on the militarized male fantasy of efficient nonlethal sonic weaponry, it was not surprising that a series of somewhat erratic, nomadic, and nonmilitarized infrasonic schemes were dreamed up by musicians operating at the periphery of the vibratory continuum, imagineering another minor, microcultural, distinctly cyberpunk ("the street has its own uses for military tech") orientation.

In a 1997 article in *Wire* magazine, "Exotic Audio Research," all manner of peripheral sonic research into imperceptible frequencies of the audio and



radio spectrum was reported, including investigations into infra- and ultrasound, which attempted to redirect the energy of the military-industrial-entertainment complex, to channel its own energy against it, and make audible its most concealed activities.[25] But this interest in the frayed edges of sonic perception in an artistic context dates back much further. In the 1970s, during a conversation regarding infrasound between writer William Burroughs and Led Zeppelin guitarist Jimmy Page, Burroughs, notable here for his writings describing sonic tactics for instigating riots,[26] revealed his interest in the potential of harnessing the mantric potential of low-frequency audio vibrations, wondering "whether rhythmical music at . . . the borderline of infrasound could be used to produce rhythms in the audience."[27] His curiosity was shared by many related to industrial music in the postpunk period, most infamously, the "Wreckers of Civilization," Throbbing Gristle, whose deployments of ultra- and infrasonic emitters on neighbors is well documented in the almost mythological literature that surrounds the history of the group.[28]



As with the many references to military research into sonic weaponry, the pop manifestations often seem equally veiled by mis- and disinformation. One story in the now-defunct music newspaper *Melody Maker* told of how prankmaster, the KLF's Jim Cauty, was testing his own audio weapons system. This system was allegedly borrowed by Finnish artists Panasonic who road-tested the devices in Brick Lane, East London. In a fax to the music paper from an imaginatively named Mr. Smith, it was reported that the

> test took place to establish the parameters of the new vehicle solo and in tandem with its sister model, SS 9000K+L. The test featured new software generated for our latest commercial client, EXP LTD, and is described by Mr. Cauty as featuring "the ultimate battle between sound and commerce ending in the death of all musicians and their ascension to rock-n-roll heaven or hell as befits them." Yesterday we received communication with ex-Government employees who, in the Sixties, worked on audio weapon development with an offer of help and some ex-classified equipment. We regret any such death or damage that has resulted from our tests, but there are casualties in every war. The Triple A Formation Attack Ensemble will perform "Foghorns of the Northern Hemisphere" as part of an educational program supporting our research shortly.

After a spoof report on Cauty's sonic weaponry experiments was published in *Big Issue* magazine, Cauty was allegedly briefly put under surveillance by British authorities and spent some time in custody.[29]

These artistic deployments of infrasound within the occult undercurrents of pop musical history, and the experimental deployment of pop and rock

hits by the military for the purposes of irritation, manipulation, and torture, underline the convoluted fabric of sonic warfare. Any simplistic opposition between standard and nonstandard uses of sound, music, and technology becomes confounded very quickly in relation to the complexities of the military-entertainment complex.[30] For sure, ideological motivations aside, the military deployments, while aiming toward closing down situations as opposed to opening them up, are often as speculative as those of the self-conscious tinkering of artists. Yet the abuse of military technology by artists and musicians is one thing. The abuse of music by the military is another. Alongside artists such as Joe Banks and Mark Bain, who hack and redeploy the technologies of the military-industrial complex into unforeseen uses, aesthetic experimentation with perisonics, or dangerous sounds, becomes increasingly essential as patents are locked down and uses legislated. It is therefore necessary to be clearer about the overlaps of military and sonic culture and to begin to pick apart the active forces from the reactive ones.





1946: Sonic Dominance

4

On either side of the room, the walls are lined by gigantic stacks of speakers of erratic assembly. Some look as if they have been repurposed from wardrobes, others from TV cabinets, their electrical and cathode ray intestines ripped out to be replaced by cone-shaped woofers resembling black eyes, a visual dead end. The air hangs heavily with a pungent smoke, rippling with pulses of intensity that oscillate from one wall to the other. A chemical clock waiting to switch. Lungs constricted, chestplates rattling, the throbbing body of the crowd holds its collective breath as one pressure wave after another surges through, jogging on the spot to mobilize the momentum in dance. Spectral voices of the DJ are echoed, reverbed into ghosts—lost in the viscous blobs of bass, the magnetic vibrations of a body snatcher. This is the masochism of the sound clash and its active production of dread.

Militaries are not the only agents actively pursuing sound wars through the deployment of vibrational force. In Jamaican sound system practices related to reggae, dub, and dancehall, intense vibrational environments are enacted, producing an ecology of affects in which bodies and technologies, all functioning as transducers of energy and movement from one mode to another, are submerged. Consistent with a conception of the affective body as resonance chamber, Julian Henriques has explored the functioning of what he terms *sonic dominance* within the sound system session. For Henriques, sonic dominance is a condition in which hearing overrides the other senses, displacing the reign of vision in the hierarchy, producing a flatter, more equal sensory ratio. In his analysis, the

processing of vibration is particularly pertinent, contributing to the achievement of sonic dominance. In particular, such sound system cultures deploy what we would term a *bass materialism* in achieving this rearrangement of the senses. In the diaspora of sound system cultures that take Jamaican pop musical concepts and methods as a prototype, bass materialist practices of affective engineering through vibrational modulation are central to vernacular modes of sonic warfare that operate using competitive sound clashing. The sound clash pits bass rig against bass rig, sound "bwoy" against sound "bwoy," dubplate against dubplate, DJ against DJ in a spiraling logic of hype escalation, intensification, and mobilization of the dance. In this mode of musical competition, the desired crowd dynamic is clearly of the centripetal, afferent, attractional type. In the reggae and dancehall sound system, the viral sonic affect—which can be felt to varying degrees in hip-hop and electronic dance music sound systems—is produced by a range of techniques that congeal the collective into an entity that Canetti referred to as a "throbbing crowd."[1] If such a bass materialism has proved contagious to the mutation of electronic music in the past forty years, then what has spread is not merely the sound systems themselves, which often function as nomadic sonic war machines, moving from dancehall to dancehall, but their abstract machines, diagrams of their relationality or circuits of transduction. Such a contagious diagram can also be understood in terms of a nexus of vibration.

The sound system shares with the nexus its microcosmic or monadic relation to a broader field. Sonic dominance, for Henriques, arises when "sound itself becomes both a source and expression of power."[2] Unlike the futurist, avant-gardist legacy or rockist legacy of (white) noise music and its contemporary disciples, with its fetishization of midrange frequencies, the dancehall system simultaneously immerses/attracts and expels/repels, is hard and soft, deploying waves of bass, an immense magnet that radiates through the body of the crowd, constructing a vectorial force field—not just heard but felt across the collective affective sensorium. For Henriques, the system operates in terms of a both/and logic: physical and formal, feeling and hearing, content and form, substance and code, particle and pattern, embodying and disembodying, tactile and sonic. Quoting from psychologist of affect Silvan Tomkins, he also points to the plane of pure sensation that cuts across this nexus and its implicit self-validating or resonant affective dynamics. He argues that the processes of transduction, where one kind of energy is converted into another, creating a surplus in the process, allows access onto the plane of the nexus, whether through the loudspeakers converting electromagnetic waves of the amplifier into sound

waves, the microphone transducing sound waves into electromagnetic waves for amplification, or the collective body of the crowd transforming sonic energy into the kinetic energy of movement and dance. When philosopher of dance Jose Gil describes the plane of immanence of dance, he also alludes to the collective encounter of the nexus and the mutual composition of actual occasions from which it is produced. He describes "the construction of a virtual plane of movement where all the movements of bodies, objects, music, colours acquire a consistency, that is, a logic, or a nexus."[3] If there is perhaps a limitation on the usefulness of Gil's analysis for the conceptualization of the nexus of the sound system session, it is that the assemblage he describes is too spectacular: it is a vision of movement and a movement of vision, but it is closed in terms of participation, as are most forms of dance art rendered as something to look at. It is not that vision, an increasingly mediatic vision, is not important in the contagious dancing of the dancehall session; rather, sonic dominance draws attention to the sensory flattening activated by acoustic and tactile vibration. Moreover, this contributes to a particular mode of collectivity, activating a power of allure, or provocation. The notion of sonic dominance helps to conceptualize the nexus of vibrational force in magnetic, attractional mode. In the overpowering, almost totalitarian sensuality of bass materialism, it also illustrates the mobilization of a sonic ecology of dread: fear activated deliberately to be transduced and enjoyed in a popular musical context.

1933: Abusing the Military-Entertainment Complex

5

Funkspiel, VHF tank radio, vocoders, Magnetophones, submarine location technologies, air war radio beams, etc., have released an abuse of army equipment that adapts ears and reaction speeds to World War n +1.

—Friedrich Kittler, *Gramophone, Film, Typewriter* (1999)

Isn't it strange that in the second world war, computer technology was used to aid and abet the military-industrial complex, but by the end of our century, that technology has mutated, devolved and diversified to such a degree that Afro-American musicians, young Black British musicians can use computer technology to construct a soundtrack to the end of the industrial epoch.

—Black Audio Film Collective, *The Last Angel of History,* (1997)

A recurrent theme in many discussions of sonic warfare within the military-entertainment complex is that of the dissemination and repurposing of military technologies. This dimension of sonic warfare has been theorized in key yet underdeveloped notions in media theory and the history of technology that investigate modes of control by unearthing the military origins of everyday tools. Much recent theory has revolved around the role visual media and computers have had in the evolution of military command and communications infrastructures. The sonic occasionally features but is very much in the background in these discourses.

One media theorist who has made more room for a conceptualization of the intersection of the machines of war with the machines of noise is Friedrich

Kittler, especially in his book *Gramophone, Film, Typewriter,* where he controversially argued that all media are fundamentally military in nature.[1] Kittler's argument is more complex than the easily refutable notion that all media technologies are predetermined by their military origins, and the apparent determinism can be understood, in its evasion of human agency, as a provocation fired at sociological anthropocentrism. His approach, inflected by the mid-1980s affective climate of late Cold War dread, takes on a renewed currency in the epoch of post-9/11 asymmetric warfare. For Kittler, military research and development infects popular culture with a kind of technological contagion to the extent that, for him, the "entertainment industry is, in any conceivable sense of the word, an abuse of military equipment."[2] He maps the trails blazed by the gramophone, recording technology, and wireless after the wars of the twentieth century, noting, for example, how after World War I, "for the simple purpose of avoiding the anarchistic abuse of military radio equipment, Germany received its entertainment network,"[3] and as he argues elsewhere, broadcast radio was "just the military radio system of the First World War minus the talkback-capability."[4] For Kittler, wars catalyze new media, driving technological development through sheer excess of energy. The contagion of military technology spreads through misuse, or reverse engineering, with knowledge acquired from espionage, accident, or experimentation.



Kittler points to three phases of military influence on media technologies, from storage to communication to ubiquitous computation. Phase 1 was initiated by the American Civil War and the development of storage devices for acoustic (gramophone), optical (film), and writing (typewriter) data. The second phase emerged around World War I and the development of electric transmission media for these data in the form of radio and television. Phase 3 began around World War II with the emergence of cybernetics and the protocomputer of the Turing machine, culminating in ubiquitous digital processing, which folds preceding modes into a metamedia. Crucially, it seems, for Kittler, while analog media were assuming the appearance of prosthetic extensions of the body, human thought was being modeled in computation and feedback machines at the same time. War therefore drives technological evolution and substitutes human subjects with automated processes.[5] Peace becomes war by other means through the platforms of media technologies that have their own evolutionary autonomy in excess of human needs and desires.

The crucial issue here is not simply the erroneous claim that all technological media are invented by the military in periods of war,[6] but rather how weaponry



and logistic, tactical, and strategic conditions serve to catalyze and pressure convergence, reconnection, and innovation in media and that all other cultural deployments serve merely to camouflage a militarization of the minutiae of urban existence. No doubt, as Winthrop-Young argues, it would be possible to explain aspects of the origin of most of the media around which Kittler's argument revolves in nonmilitary terms, especially with the many recent instances of entertainment media preceding military use, for example, simulation technologies developed in the field of video games that have migrated back to the military. But this misses the more fundamental argument about modern society that has been asserted since the early twentieth century by the Italian futurists, Ernst Junger, and McLuhan right up to Virilio and Kittler. For these thinkers, war has come to mean much more than battles between nation-states; rather, it expresses an ontological condition. For all of these writers, the concept of war becomes an attempt to describe a low-intensity warfare that reconstitutes the most mundane aspects of everyday existence through psychosocial torque and sensory overload.

As with Foucault and with Deleuze and Guattari, Kittler's extended concept of war contains a certain ambiguity. While for Foucault's concept of power as developed particularly in *Discipline and Punish* and *Society Must Be Defended,*[7] war is coextensive with the social field, a current flowing through every niche, for Deleuze and Guattari, in *A Thousand Plateaus,* war is also an undercurrent, with its militarized instantiation only a captured subset. It is an undercurrent that attains a cosmic transversality, cutting across all strata, human or nonhuman, with local outbreaks in every milieu, as abstract turbulence.[8] For Kittler, the ambiguity of war pertains to the immersivity of the military-inflected, ubiquitous media environment. Each has its own response to the ubiquity of war: for Foucault, resistance; for Deleuze and Guattari, the construction of rhythmic war machines; and for Kittler, the abuse of militarized media technologies. Marking out a kind of cyberpunk politics of frequency, Kittler asserted that if "control, or as engineers say, negative feedback, is the key to power in this century, then fighting that power requires positive feedback. Create endless feedback loops until VHF or stereo, tape deck or scrambler, the whole array of world war army equipment produces wild oscillations. Play to the powers that be their own melody."[9]

While Kittler's analysis through the prism of militarized technological evolution ensures that the abuse of hardware and software is placed at the center of a nonmilitarized sonic warfare, its technological determinism leaves

underdeveloped some of his own key insights. It is therefore helpful to submerge his theory of media into a more general affective ecology in which technical machines become just another entry in the inventory of actual entities in a nexus of vibrational experience. After all, rigorous experimentation with what a sonic nexus can do means that bodies deserve as much abuse as technical media. If war saturates modern societies right down to the microphysical fabric, then it does so using an array of distributed processes of control, automation, and a both neurophysical and affective mobilization: the military-entertainment complex as a boot camp therefore, optimizing human reaction speeds, fabricating new reflexes for a postcybernetic condition. Media technologies discipline, mutate, and preempt the affective sensorium. Entertainment itself becomes part of the training. During the late Cold War, as Kittler himself noted in a wonderful yet underdeveloped aside, "Our discos are preparing our youth for a retaliatory strike."[10]

Kittler's theory can certainly be built on to assist in the construction of a theory of sonic warfare. This book, however, diverges from him and his musical inspiration. When he wrote in the mid- to late 1980s, the soundtrack to the themes of sonic warfare for him seemed to be the rock music of the 1960s and 1970s, from the Beatles to Pink Floyd, with some brief mention of more experimental sound practitioners, from Stockhausen to Laurie Anderson and William Burroughs. Twenty years later, the concept of sonic warfare developed here is soundtracked more by the electronic musics of the Black Atlantic.

403–221 B.C.: The Logistics of Deception

6

Weapons are tools not just of destruction but also of perception—that is to say, stimulants that make themselves felt through chemical, neurological processes in the sense organs and the central nervous system, affecting human reactions and even the perceptual identification and differentiation of objects.

—Paul Virilio, *War and Cinema: The Logistics of Perception* (1989)

All war is based on deception.

—Sun Tzu, *The Art of War*

Between the two world wars, the visual logistics of the photograph and cinema (as described by Paul Virilio in *War and Cinema*) were joined by the expanding repertoire of the "logistics of sound," its networked ecology, with the advent of interwar mass radio transmissions and the carceral archipelago of performance spaces, the distributed system of audiospecular enclosures deployed for entertainment and propaganda purposes and known more widely as cinema. The history of war, as traced by Virilio, revolves primarily around the mutation of perception over territorial and economic concerns; its evolution accelerates an osmosis between biological and technical nervous systems. Just as Virilio found the logistics of military perception within the history of cinema, especially with the emergence of cybernetics in the postwar period, we can locate, updating an ancient history of acoustic warfare, an undercurrent of research into sonic tactics guiding a symbiosis of noise, bodies, and machines. Across the continuum of war, from sonar to nonlethal acoustic weaponry, this logistics of perception

in its vibratory, resonant, affective, and virtual sonic dimensions is now assuming new permutations in cultures mutated by the impact of global terrorism and asymmetric warfare.

This logistics of (im)perception does not merely seek to intervene in the "normal" functioning of psychophysiological circuitry, but, in McLuhanist terms, also involves perceptual prosthetics: an extension or an amputation. Conceived differently, for philosopher Baruch Spinoza, the focus shifts from what a body is, even in its technologically extended sense, to its powers—what it can do. The body of sonic warfare is therefore always a speculative question, which does not return home to a pregiven human, corporeal demarcation. The episodic history of sonic warfare's perceptual assemblages can therefore equally be found in electronic and electromagnetic cartography, the distributed nervous system of technical sensors that feed it, and the flood of information these systems produce.

In the cybernetic phase of martial evolution, which emerged out of the detritus of World War II, turning this data flood into workable knowledge became as important as the efficiency and accuracy of weapons systems. The logistics of perception has been confronted by the ravenous information hunger of military systems, generating a chain reaction of problems in the gathering, transfer, and processing of data. The more sophisticated the military's distributed nervous system, the more overpowering the sheer weight of information to be dealt with.[1] And as an unavoidable corollary, the more overexposed the battlefield becomes, the more appearance gives in to an array of camouflage, decoys, jamming, smokescreens, and electronic countermeasures. To be perceived is to be "taken out." So investment in forces co-evolves with the investment in their concealment. Stealth, secrecy, and the logistics of perception signal, for Virilio, that the war of images has in fact superseded the war of weaponry. Whether we  agree with Virilio's historical argument or not, his insight is to draw attention to how the evolution of weapons and armor is paralleled by the co-evolution of visibility and invisibility and, by implication, of audibility and inaudibility.

In the late 1920s, a series of strange structures started appearing in Kent on the south coast of England. The plan of the British air force was to set up a chain of "concrete ears" along the coast that would peer out over the channel of water that separated the island from the Continent. It was a plan never completed. Looking like prehistoric satellite dishes and resembling the concrete styles catalogued in Virilio's very Ballardian book of photography, *Bunker Archeology*,[2] these structures were sound mirrors used as acoustic detection early-warning devices designed to pick up sounds from approaching enemy

aircraft.[3] There were three types of sound mirror. With the circular, concave 20- and 30-foot-diameter concrete bowls, movable, cone-shaped metal sound collectors were used, connected by tubing to stethoscopes worn by the operators. The other type were strip mirrors, curved in elevation and plan of 26 by 200 feet. With these structures, microphones were placed on a concrete forecourt in front of the mirror and wired to a nearby control room. All the sound mirrors were located in positions that attempted silence. A 1924 report suggested that the sound mirrors were ten times more sensitive than the human ear, and they were tested by blind listeners in 1925. Yet operation problems due to noise from the sea, wind, local towns, and ship propellers rendered the structures onto the sad scrap heap of twentieth-century dead media. Some of these lonely, decaying structures persist to this day and can be seen at Abbots Cliff between Dover and Folkestone, West Hythe, and on the Dungeness shingle at Denge. Yet these concrete ears lay the foundation to the virtual front of vibrational warfare and the much more successful radar systems deployed in World War II.

As Virilio has argued, the emergence of radar and sonar (sound navigation and ranging) as vibrational and electromagnetic techniques of rendering objects perceptible in electronic warfare has developed to the extent that now, "the projectile's image and the image's projectile form a single composite."[4] Since radar signals have poor penetration of water, the seabeds and surface of the planet are populated by both passive and active ultrasound (above 20 kilohertz) devices (including sonar platforms, sonobuoys, hydrophones, towed arrays) equipped to scan the suboceanic depths and provide the data required for a sonic tracing of the hydrosphere, differentiating the acoustic signature of enemy craft using "pinged" high-frequency signals from ambient noise. Of course, like all other techniques of warfare, this sonar scanning implies a whole repertoire of countermeasures related to signal jamming and tactics of deception through acoustic camouflage and the use of decoys.[5]



Sonic deception operates as a tactic of simulation. The resort to deception as a means of fighting without fighting, nonconfrontation or the minimization of armed engagement, is a strategy that has drawn much inspiration from Sun Tzu's ancient treatise, *The Art of War.* With reference to this text and Lao Tzu's *Tao Te Ching,* both of which became increasingly known to the Occident in the twentieth century, François Julien has explored some of the general tendencies of Chinese strategic thought and their divergences from Western military philosophy. Julien noted that Chinese martial concepts often revolve around what he terms the potential or propensity of things: "Warfare has often seemed the

domain of the unpredictable and of chance (or fatality) par excellence. However, from early on, Chinese thinkers believed that they could detect in warfare's unfolding a purely internal necessity that could be logically foreseen and, accordingly, perfectly managed. . . . Chinese strategic thought stands as a perfect example of how one can manage reality and provides us with a general theory of efficacy."[6] Rather than moral concerns, it was efficacy, and the preparation for a future configuration of events through predetermining them as much as possible, that provided the basis for the strategic importance of nonconfrontation. Julien draws attention to the concept of *shi,* or "potential born of disposition," as the engine of such strategic notions. Here *disposition* refers to the conditions encountered that, whatever they are, must be turned to maximum advantage with minimum effort through the extraction of their potential. Disposition can derive from the shape of objects or topographical gradients. Such thinking, which revolved around the notion of *shi,* displayed an "extreme commitment to penetrating the real nature of all determining factors and doing away with all possible illusions" as it was "only through shi that one can get a grip on the process of reality."[7]

Julien points to the central structural difference between key Chinese and European military thought. For the ancient Chinese thinkers such as Sun Tzu, *shi* was the essential concept of military strategy, whereas for modern military thinkers such as Clausewitz, "means" and "end" were essential.[8] Julien describes the Western model as revolving around a "heroic or tragic vision" of the "'head on clash,' or confrontation carried to the crisis point in a situation offering no escape."[9] The Chinese model Julien refers to, and to which there was no doubt a multiplicity of competing approaches, preferred fluid adaptation to the changing terrain, preparedness for this constant shifting ground, and the renewal of potential produced by the mutating environment. At the same time, in this model, the enemy would be forced to become relatively fixed, subordinating its energy to constantly avoiding being taken by surprise, and therefore preventing the enemy from taking control of the situation. Against the Occidental heroic vision, Julien notes that for the Chinese, "a true strategist always wins 'easy' victories. . . . True strategical skills pass unnoticed."[10] Adherence to *shi,* on the other hand, provides a way of leading the conflict to resolve itself with the least possible heat.[11] In summary, this central structural difference results in a number of key contrasts between the two martial approaches: probability versus propensity, "decisive and direct" action versus "indirect destruction," "appropri-

ate means and predetermined ends" versus "the setup and its efficacy," and the achievement of aims versus "the shaping of effect."

For Julien, "whereas tragic man clashes irrevocably against superior powers, resisting all surrender . . . , the Chinese strategist prides himself on his ability to manage all the factors in play, for he knows how to go along with the logic behind them and adapt to it. The former *fatally* discovers, all too late, his 'destiny'; the latter knows how to anticipate the propensity at work so that he has it at his disposal."[12] From the perspective of ancient Chinese military thought, even the Clausewitzian concept of friction is unnecessary. Friction, Julien argues, "was conceived as a means to account for a troublesome gap in Western strategic thought: the disparity between the plan drawn up in advance which is of an ideal nature, and its practical implementation which renders it subject to chance. The Chinese concept of *shi,* inserting itself into the distinction between what Westerners have opposed as 'practice' and 'theory,' and thus collapsing that distinction, shifts 'execution' toward something that, given the propensity at work, operates of its own accord and excludes any uncertainty or inadequacy: neither deterioration nor friction is involved."[13]

Across the twentieth century, the exploitation of propensity as developed in Chinese strategy, alongside developments in cybernetics, mathematics, physics, and biology, has served to destratify Western military strategy and practice. Thinkers such as Sun Tzu, and his emphasis on deception, have become core to both Western military elites and guerrilla networks waging asymmetric conflicts.

1944: The Ghost Army

7



"Ghost Army" was the nickname given to a division of the U.S. Army, the Twenty Third Special Troops, stationed in Europe during World War II. They consisted of artists deployed in the fabrication of camouflage and fake inflatable equipment, and sound and radio engineers using equipments pioneered at Bell Labs. The Ghost Army's aims were to trick the enemy into reacting against the presence of a nonexistent phantom army using the sounds of troops, tanks, and landing craft, allowing the actual troops to maneuver elsewhere. In addition to the Ghost Army, Division 17 was working on a joint army-navy project based on "The Physiological and Psychological Effects on Men in Warfare," research orchestrated by Bell Telephone Labs and consisting of physiologists and sound engineers, including the inventor (Harold Burris-Meyer) of the new stereophonic system that made possible the recording of music for Walt Disney's *Fantasia*. In a short excerpt of archive footage from an army training film during World War II, an engineer is shown cutting a "dubplate" of sound effects such as bulldozers, the construction of a bridge, and an armored column of troops. The records were then filed at a library at the Army Experimental Station and rerecorded in sequence onto wire. The engineer is filmed mixing down a soundtrack onto a wire recording using three turntables.[1]

This sonic deception involved the generation and distribution of sounds to produce the sonic experience of the battlefield in order to confuse, mislead, or distract the enemy. Blending actual recordings and artificially generated noise, it was targeted at the enemies' ears and listening devices. The less effective the

enemy's visual capabilities, the more powerful sonic deception could be. Visual concealment by smoke or the dark of night obviously assisted the process. Moreover, climate and geography intimately affected the range of signals.[2] Based on the intricate logic of sonic effects, the sound ranging of the enemy attempted to estimate the distance of the sound sources. For example, the Doppler effect dictated that sound increasing in frequency was approaching and sound decreasing in frequency was retreating. Such a manipulation of frequency was therefore deployed to trick the enemy or was deliberately avoided in the recording of sound effects.[3] Yet, in practice this was unreliable, and it required the enemy to remain relatively static.

These techniques of sonic deception derived from an accident. It was noticed that when dive bombers came plunging from the sky, with their characteristic "screaming whine caused by a siren deliberately designed into the aircraft . . . it instilled a paralyzing panic in those on the ground. . . . For Division 17 of the National Research Defense Committee, the lesson was clear: sound could terrify soldiers. . . . So they decided to take the concept to the next level and develop a sonic 'bomb.' . . . The idea of a sonic 'bomb' never quite panned out, so the engineers shifted their work toward battlefield deception."[4] Sonic deception therefore emerged out of the power of audible vibrations to generate an affective ecology of fear.



This sonic manipulation of the enemy involved a number of key tactics of frequency to produce virtual sound. To create a phantom army in sound, its presence had to be fabricated using what is often referred to as the "acoustical intimacy" of binaural hearing, that is, the ears serve as two input channels for sound and together create a whole virtual field:



> Hearing is imperfect and can be fooled, especially when other senses, such as sight, are also involved. We do not hear in the precise way an oscilloscope measures sound waves. How and what we hear depends on context, both physical and emotional. . . . Presence emerged as the complex result of improvement in several key components of the sound recording and playback system. First, the recordings themselves were purer, clean of masking sound or obtrusive background noise. Second, the individual sound effects were mixed into multiple channels and then played back through multiple speakers, both on a single vehicle or vehicles separated by hundreds of yards. The psychoacoustical effect was that, as sound moved between speakers, the listener heard a phantom sound, a sonic illusion, but one that did not jump from one sound source to another. Rather it lingered in the space between the two speakers, creating a sense of spatial reality for the sound. . . . The speaker itself evolved from a rigid metallic horn that gave off volume but sounded tinny and flat, like a megaphone. Now a larger, flexible speaker came into play.

Its fifteen-inch diameter allowed it to handle "bass" or low frequency sound waves . . . frequency response was richer . . . natural harmonics of a sound, sometimes called *overtones* . . . to the human ear, those overtones, which resonate at mathematically predictable frequency intervals, and not usually audible as separate sounds . . . the impression that sound was coming not just from the speaker itself but also from beside it and behind it.[5]




As sonic deception became taken more seriously, it fed into the improvement of speaker technology. As Bell Labs noted, in World War II, the new "military acoustic devices were not just copies or minor physical modifications of existing instruments . . . but rather basically new designs." In fact, because of their newfound fidelity to presence, they would "become popular in the civilian world after the war in stereo hi-fi systems and studio monitors."[6] Aside from new innovations in sound technology, older devices such as the magnetic wire recorder were dusted off to solve the problem of skipping phonograph needles in mobile vehicles in the field. During the 1930s, Hitler's Ministry of Information and Propaganda was deploying wire recorders to deceive listeners about his actual location by playing prerecorded speeches on the radio and pretending that they were live broadcasts. The tactics and technologies of sonic deception therefore add yet another instance to Kittler's notion that popular sonic media entail the "misuse" of military technologies. And these techniques of virtual sound serve as a precedent to deployments within the U.S. invasions of Iraq and more recent military research into directional sonic lasers.

1842: Sonic Effects 8

In their urban ecology of sonic effects, Jean-François Augoyard and Henri Torgue set out a novel approach to auditory experience. Noting the "surplus of feeling" in sonic perception, its ability to invoke astonishment, wonder (and, it should be added, shock and awe) within music or visual media, they aim to expand this out into an analysis of the vibrational experience of the city. They note that "as soon as a sound physically exists, it sets into vibration a defined space." For them, the fixed categories of the sound object, as minimum perceptual unit of hearing and the soundscape as macrocategory descriptive of the entirety of audible vibration, are inadequate.[1] Rather, they argue, the sonic effect as an open concept constitutes a new paradigm of analysis. In a sense, it runs in parallel to Greg Lynn's topological move within the realm of architectural form against the unique and the general. The concept stands "halfway between the universal and the singular, simultaneously model and guide. . . . Rather than defining things in a closed way, it opens the field to a new class of phenomena by giving some indication of their nature and their status. . . . It characterizes the modal or instrumental dimensions of sound."[2] The effect, for them, intervenes between cause and event: "The effect is not an object in itself. Noise or sound, for instance, do not physically 'change' in the Doppler effect; it is the relation between the observer and the emitting object that is modified, when the former or the latter is moving at sufficient speed . . . the effect not only indicated a necessary cause; it is also the mark of an event. . . . The context surrounding the object and its appearance . . . the perceptible 'effect' is directly linked to a circumstantial

cause. . . . Outside of the logic of objects and attribution that became familiar to us in the West, the Stoics were developing another logic dealing with events and actions in progress."[3] Augoyard and Torgue therefore submerge the sonic event in an ecology of vibrational effects, out of which, the subject and object emerge. They write that "the sonic effect, sometimes measurable and generally linked to the physical characteristics of a specific context, was not reducible either objectively or subjectively. The concept of the sonic effect seemed to describe this interaction between the physical sound environment, the sound milieu of a social-cultural community, and the 'internal soundscape' of every individual."[4]

The result is the revision of the notion of the sonic city "as instrument" as merely possessing "passive acoustic properties," replacing it instead with a "sonic instrumentarium of urban environments"—an idea of playing the city via its design, and thereby modulating its vibrational effects. The effect, rather than a sound object as such, approaches, in William James's terms, a sonically pure experience, an experience of relation and thereby stands as an affective fact in its own right, in addition to the sensed sound.[5] Most of their text in *Sonic Experience* is devoted to providing a glossary of effects, including resonance, echo, rumble, and reverberation, analyzed in terms of their relevance across the scales from acoustic physics, socio-psycho-physiology to aesthetic, architectural, and urban design.

Despite appearing to break with the politics of silence of the acoustic ecology movement, Augoyard and Torgue's notion of sonic experience remains centered on a phenomenology of sonic perception in which human audition is given primacy. As a notion of postcybernetic warfare entails wars between media, machines, as much as it does between human bodies, then this notion of sonic experience should be extended toward an ecology of vibrational affects. To their sonic phenomenology of effects, an environmentality of affects is preferable, resting on an ontology of vibrational force in which a body becomes merely another actual entity in a vibrational event, assuming not necessarily any more significance than the resonances between other entities within this nexus. However, the helpful insight of Augoyard and Torgue's theory that can be retained here is that the body is rendered as a multi fx-unit, as transducer of vibration as opposed to a detached listening subject isolated from its sonic objects. Brian Massumi has described the affective sensorium in parallel fashion:

> It is best to think of it as a resonation, or interference pattern. An echo, for example, cannot occur without a distance between surfaces for the sounds to bounce from. But the

resonation is not on the walls. It is in the emptiness between them. It fills the emptiness with its complex patterning. The patterning is not at a distance from itself. It is immediately its own event. Although it is complex, it is not composed of parts. It is composed of the event that it is, which is unitary. It is a complex dynamic unity. The interference pattern arises where the sound wave intersects with itself. The bouncing back and forth multiplies the sound's movement without cutting it. The movement remains continuous. It remains in continuity with itself across its multiplication. This complex self-continuity is a putting into relation of the movement to itself: self-relation. . . . Resonation can be seen as converting distance, or extension, into intensity. . . . With the body, the "walls" as sensory surfaces.[6]

Sonic warfare therefore is concerned with the generation, modulation, and dampening of vibrational carrier waves of sonic affect. This is as much about the amodal, nonsensuous, the abstract, cross-mediality of rhythm as the sense of sound itself. If amodality is taken to ontologically precede the designation of a sensation to a specific exteroceptive sensory channel (the five senses), then the clinical conception of synesthesia would have to be inverted from pathological condition to foundational of the affective sensorium.[7] Such a discussion opens the sonic onto the vibrational substratum out of which it individuates as a specific sensory modality. Interestingly, many ascribe to the sonic a strange intermediary sensory role. Deleuze and Guattari assert that perhaps sound plays a piloting role in synesthesia.[8] Stephen Connor has argued that this derives from sound's interstitial qualities, that it has the tendency to drift in between the other senses.[9] French film theorist of audiovisual perception Michel Chion argues that the sonic, within film, possesses a strange power to render a block of sensations that includes both the tactile and the visual. He notes, for example, that "some kinds of rapid phenomena in images appear to be addressed to, and registered by, the ear that is in the eye, in order to be converted into auditory impressions in memory."[10] For him, "the ear's temporal resolving power is incomparably finer than that of the eye," and this allows cinema to go beyond a mere correspondence between the senses toward what he called an "intersensory reciprocity," transposing a "sonic velocity into the order of the visible."[11] More important, he points to rhythm as the locus of sensory transposition. Moreover, he prefers the trans-sensorial to that of the intersensorial.[12] It is an "element of film vocabulary that is neither one nor the other, neither specifically auditory nor visual . . . when a rhythmic phenomenon reaches us via a given sensory path—this path, eye or ear, is perhaps nothing more than the channel through which rhythm reaches us."[13]

In any sonic experience therefore, it is primarily the vibrational (microrhythmic) nexus of sensory modalities that constitutes an encounter. The affective sensorium of an entity becomes a rhythmic transducer composed of not just the five exteroceptive channels that open onto the external environment, but also the viscerality of interoception, which is sensitive to intensity minus quality and in a sense preempts exteroception in that it makes decisions before the consciousness of extensive sensory objects fully emerges. Where there is a visceral perception initiated by a sound and in a split-second the body is activated by the sonic trigger, then the gut reaction is preempting consciousness. Interwoven with the proprioception of the feeling of the moving relations of the body, a tactility facing inward, the affective sensorium as polyrhythmic nexus is a synesthetic synthesizer. For Massumi, synesthesia constitutes the perspective of the virtual. It can therefore be concluded that if synesthetic perception is intersensorial, it is so only to the degree that it faces the actual, whereas amodality proper, facing the virtual, is trans-sensorial and, as Chion maintains, rhythmic. This tension between transensoriality and the sonic produces the concept of unsound, the not yet audible, the dimension of sonic virtuality.

1977: A Sense of the Future

9

Our music foretells our future. Let us lend it an ear.
—Jacques Attali, *Noise: Political Economy of Music* (1985)

Around thirty years ago, French economist Jacques Attali asked whether one could "hear the crisis of society in the crisis of music?"[1] But that was only the conventional side of his argument. More singularly, he inquired whether turbulent transformations within the world of music were in fact prophetic of political or economic crises to come. Beyond controversially suggesting a basic intersection between music and violence, Attali formulated a kind of stilted audio futurology. Around the same time, there were certainly other compelling and engaging approaches to the future in circulation. Most potent, cyberpunk fiction and cinema, in their revision of science fiction's imperialist perspective on the future, found clues in the present and extrapolated from them, visualizing a near future.

The sonic as portal, on the other hand, as a sense of the future, is a thread that runs from the Italian futurists' art of war in the art of noise at least to Jacques Attali's book *Noise.* Instead of straining the eye toward the distant horizon or even making short-term projections or prophecies, the idea of sound as a sense of the future keeps its "ear to the ground," listening for microsignals, in an immediately present future, where the present virtually coexists with the resonances and vibrations of the past and opens on to its futurity. A closer listen to the sonic dimension of the affective sensorium reveals a model for challenging the time

lines that underpin many traditional futurisms and futurologies. Instead of gazing to the far future, attention returns to the futurity folded into the present. The sonic encounter opens out onto an achronological nexus. Anticipation, sensing the future, has always been more a preoccupation of the ear, of audio culture. The ear probes the future through listening for those clues that pass so quickly they could not have been present: phantoms, hallucinations, initiated by affect, or anticipation, or perhaps dread, because as one critic argued toward the end of the last century, "by the time we get to cyberpunk, reality has become a case of the nerves—that is, the interfusion of nervous system and computer matrix, sensation and information—so all battles are fought out in feeling or mood, with dread exteriorized in the world itself."[2] The future probes us through hearing, before any encounter with that which strays into the visual field. In film, you hear the pounding of impending doom, the seductive allure of the new flesh, and the gut-wrenching tension of imminent catastrophe long before you see its face, if it has a face. But does this cinematic convention of sonic affect also map onto the wider audiosocial milieu?

Everyone knows that in uncertain times, a species looks for clues to its future. For example, in *War and Cinema,* Paul Virilio traces the co-evolution of technologies of the eye with the arm, of vision machines with killing machines in an attempt to understand the significance of the human race passing through the virtual threshold of nuclear obliteration under the watch of a planetary vision machine. As he notes, "Seeing and foreseeing . . . tend to merge so closely that the actual can no longer be distinguished from the potential. Military actions take place 'out of view,' with radio-electrical images substituting in real time for a now failing optical vision."[3] Yet in describing the auditory culture of the Inuit, Marshall McLuhan pointed out that "to them, the ocularly visible apparition is not nearly as common as the purely auditory one: hearer would be a better term than seer for their holy men."[4] But in the acoustic spaces of the early twenty-first century, what are we to make of Attali's implied audio prophecy? Perhaps it is more productive to understand Attali's futurological argument and theory of noise as based on recurring audio hallucinations, premonitions brought to him by sound. Through seeking some clarity in Attali's sometimes hazy apparitions, some broader questions can be approached concerning the contagious affective networks of sonic warfare.

While intended as an argument in political economy, of changes in cultural superstructure preceding those in the economic base, Attali's futurology indirectly raises the affective issue of hearing's particular relationship to anticipa-

tion and dread. He locates sonic culture's future-sensing analytical power in its liquidity compared to other cultural fields, a suppleness that attunes it to rhythmic and morphological potentials: "It explores, much faster than material reality can, the entire range of possibilities in a given code. It makes audible the new world that will gradually become visible, that will impose itself and regulate the order of things; it is not only the image of things, but the transcending of the everyday, the herald of the future."[5] In refutation of Attali's historical claims, some critics have bothered to disprove his chronologies. In *Noise, Water, Meat,* for example, Douglas Kahn attacks him where he points to the modern connection of music and war through the Italian futurist concept of noise. Kahn, in his critique of the basic claims of his audio futurology, quotes Attali when he writes that "it is not by coincidence that Russolo wrote his *Art of Noises* in 1913; that noise entered music and industry entered painting just before the outburst and wars of the twentieth century, before the rise of the social noise."[6] Kahn, however, points out that in fact, the reverse was true; music was echoing war: Russolo's signal had already been delivered by Marinetti in 1911 in his possessed data bursts from the trenches of the Italian-Turkish war in Libya.[7] But taking Attali's argument as the utterings of someone encountering audio apparitions, Kahn is perhaps shooting at the wrong target.

Aside from wonky chronology, Attali's theory rests on a series of problematic conceptual mappings. First, he formulates the relationship between music and noise as that of coded sound to uncoded sound. Noise, as the outside of a regime of coded sound, continuously perturbs music, threatening its regulation of sonic flow. Noise, in fact, as it scrambles music's signal, destroys, for Attali, the coding regime, transforming the relationship between inside and outside and spawning a new musical order in the aftershock of its arrival. For Attali, noise brings with it the future seeds of a new musical regime. At several points in his text, Attali abstracts this theory of noise and music into one of chaos and order, whereby noise, as an agent of chaos, trashes harmonic and metric structures while delivering an emergent order out of the shadow of the old. From here, Attali transposes his concepts of order and chaos onto the parallel social dynamic of violence and social order: noise and music, chaos and order, dissonance and harmony, violence and social order, war and peace. Cutting across this conceptual matrix, he points to four modes of sonic organization, at once both historically successive and virtually synchronous, which he terms *sacrifice, representation, repetition,* and *composition.* These modes, respectively, can be understood as corresponding to tribal, sovereign, disciplinary, and cybernetic

networks of power. Noise, in Attali's theory, not only plays a crucial role in the creation-destruction cycles of musical evolution, setting in motion the mutation of sonic culture, but also, he argues, anticipates broader social crises and transformation.

Attali's final audio-social order, the one that is emerging from repetition, he dubs *composition.* Attali's depiction of the incoming regime is vague. He does, however, make some speculations on its likely characteristics. So, for example, he notes that "composition proposes a radical social model, one in which the body is treated as capable not only of production and consumption, and even of entering into relations with others, but also of autonomous pleasure."[8] Composition "would be done first and foremost for ourselves. . . . It lies primarily outside of communication. . . . The tools of composition will be tools that are linked to the body: prostheses."[9] Here the listener becomes the operator and the consumer the producer: "The future is no longer to listen to music, but to play it."[10] Attali is correct to focus on the body-machine in this new mode of composition, but this prophecy certainly needs untangling from his solitary, masturbatory conclusions.

While Attali is vague about the audio-social system that composition will herald, some of the details of his audio hallucinations can be filled in through looking elsewhere at some of his futurological writing on the topics of cyberspace and global war. In *Labyrinths,* he remarks that "time itself does not flow but is spread out in space with comings and goings, with spirals and blind alleys, and distant proximities as well as illusory distances."[11] The concept of the labyrinth encapsulates, for him, the fractal nature of cybernetic power. He goes further to assert that the "the labyrinth is the material manifestation of a collective unconscious."[12] Cybernetic culture for Attali is continuously producing what he calls "virtual nomads," within a planet destined to become an "eco-labyrinth." Moreover, the body is itself a labyrinth ("brain, ears, viscera, nervous system, fingerprints, reproductive code").[13] Cyberspace parallels this physical and physiological labyrinthine patterning, with networks of microprocessors and software whose binary instructions and structures are an incessant series of bifurcating, forking paths and logic gates. This labyrinthine mode beckons what Virilio would describe as the logistics of deception of the electronic phase of warfare. As Attali describes, "Military strategy is always an affair of decoy and misdirection. And in trench warfare, what more perfect labyrinthine form than the network of trenches. . . . War and violence will once more depend upon a labyrinthine art of ruses, detours, the creation of dead ends, and blockages

of networks. Terrorism will be exercised above all in attacking power through systems of transportation, computer, and media networks."[14] If Attali's audio futurology is pushed further, particularly his depiction of the emergent mode of composition, then it should reveal at least a premonition of the global turbulence of the age of asymmetry.[15]

Notwithstanding the fact that his post-*Noise* prophecies hardly constitute a revelation in the early twenty-first century, in the depiction of the emergent fourth mode of audio-social organization, Attali has also been charged with vagueness by the followers of all major pretenders of late-twentieth-century audio futurism, from punk to hip-hop, from industrial to techno, from glitch to generative music. It is necessary to rely on others to fill in the blanks and take his theory forward. In the section of *Energy Flash* entitled "Ghost in the Machine," music critic Simon Reynolds addressed Attali's audio apparitions and his sense of the futurological, predictive power of sonic culture. Quoting Arthur Kroker, "Just like the virtual sound-objects in sampler music technology, subjectivity today is a gaseous element, expanding and contracting, time-stretched, cross-faded, and sound accelerated," Reynolds offered "sampladelia" as prophetic of cyborgian mutation. He located DJ culture at the threshold of Attali's modes of repetition and composition: "DJs are chronic consumerists and collectors who nonetheless use their stockpiling exercise as the basis for composition in the literal sense, 'putting things together.'" Reynolds goes further than most others in unraveling Attali's allusions in the context of late 1990s rave culture: "If music is prophecy, as Attali contends, what kind of social organisation or disorganisation is heralded by dance music? The transformation of music into a mass marketed commodity (sheet music, records) anticipated the late twentieth century triumph of what the Situationists called the spectacular-commodity society (with its alienated, passive consumer/spectator). Rave culture's decentered networks—cottage industries, micro-media, and temporary one off gatherings—may herald some post-corporate heterotopia of the late twenty-first century. Then again, sampladelia might equally be a component of a Krokerite dystopia of 'cold seduction': a cool hallucinatory culture of special effects personalities moving at warp speed to nowhere."[16] If Attali is construable only in this way, as yet another (musical) prophet of the ethico-aesthetic impasse of postmodernity, then ultimately his audio futurology disappoints.

1913: The Art of War in the Art of Noise 10

Cut away the future, and the present collapses, emptied of its proper content. Immediate existence requires the insertion of the future in the crannies of the present.

—Alfred N. Whitehead, *Adventures of Ideas* (1993)

What is left of the futurist thought of sonic invention in an age when the military-entertainment complex cuts to the micrological core and control operates flat with becoming? Did the future get lost in the labyrinth of Web 2.0, in the rhizomatic networks of ubiquitous computation? At the turn of the twentieth century, the thermodynamic machines that were transforming the landscape, particularly the train and the automobile, obsessed futurism. At the end of the twentieth century, the model was instead the machines of cybernetics, whereby human thought and perception could be conceived of in terms of information processing. The futurist orientation to time was not so much futurological, that is, of predicting that which was to come, but rather of developing tactics to accelerate out of the tedium of the present. As Russolo laments in *The Art of Noises,* "Each sound carries with it a tangle of sensations, already well known and exhausted, which predispose the listener to boredom, in spite of the efforts of all musical innovators."[1]

Futurism here is a frustration with the sonic present: "Our ear is not satisfied and calls for ever greater acoustical emotions."[2] The art of noises for the futurists was a battle over the modern sensorium: "By selecting, coordinating, and controlling all the noises, we will enrich mankind with a new and unsuspected

pleasure of the senses."[3] The futurist plight was of sensory intensification. Energized by their affective experience of World War I, they felt the possibility of enlivening the arts through the integration of their detritus. Through the deployment of noise-sound, "Our multiplied sensibility, having been conquered by futurist eyes, will finally have some futurist ears."[4] Despite the turgid, conservative hold on the arts with the "marvellous and tragic symphony of the noises of war," man, for Russolo, could "still find something there at the front to amaze him. He will still find noises in which he can feel a new and unexpected emotion."[5] He included Marinetti's letter from the trenches in his noise manifesto: "Violence ferocity regularity this deep bass scanning the strange shrill frantic crowds of the battle Fury breathless ears eyes nostrils open! Load! Fire! What a joy to hear to smell completely taratatata of the machine guns screaming a breathlessness under the stings."[6] As with his peers, the sonic experience of war for Russolo was overwhelming, rendering the inertia of both bourgeois visual art and music pathetic: "In modern warfare, mechanical and metallic, the element of sight is almost zero. The sense, significance, and the expressiveness of noise, however, are infinite."[7] Navigation and orientation become both synesthetic and piloted by the poisonous embrace of the sonic encounter: "From noise, the different calibres of grenades and shrapnels can be known even before they explode. . . . There is no movement or activity that is not revealed by noise. . . . But noise, which conquers the blackest gloom and the densest fog, can betray as well as save."[8] The battlefield becomes a vectorial force field in which sensory experience is dominated by the trajectory of dopplering ballistic projectiles, the whistling of shells, the murmur of artillery just out of range, and the meow of shrapnel, all marking enharmonic passages from one pitch to another, performing a kind of imminent Bergsonian critique of the cinematographic error of classical music's frozen pitches.

In *Speed and Politics,* and much more recently in *Art and Fear,* Paul Virilio attempted to go beyond futurism's dual obsessions with noise and speed, to formulate an aesthetico-political analysis that he termed *dromology.* Etymologically, *dromology* comes from the Greek word *dromos,* meaning a race, or the pursuit of speed. Virilio's starting point was the ancient Chinese martial dictum of Sun Tzu that speed was the essence of warfare. Sharing Walter Benjamin's concern with the fascist aestheticization of politics, Virilio's dromology was recurrently possessed by the ghost of Marinetti and the Italian futurist celebration of the "beauty of speed": in a typical exaltation, Marinetti wrote that "one must persecute, lash, torture all those who sin against speed."[9] For Marinetti, the ma-

chines of military-industrial capital initiated the "acceleration of life to today's rapid rhythm. Physical, intellectual and sentimental balance upon a tightrope of speed stretched between contrary attractions."[10] Virilio concluded that "futurism in fact comes from a single art—that of war and its essence, speed. Futurism provides the most accomplished vision of the dromological evolutionism of the 1920s, the measure of superspeed!"[11] Virilio's melancholy apocalyptic dromology, while clearly, alongside Friedrich Kittler, key to this investigation, proves, however, too one-dimensional, as he seems, under the spell of Marinetti, overly obsessed with acceleration, fastness, and the noisy sonorization of art rather than with the broader ecology of sounds and speeds. The error of both the futurist politics of noise and the reactionary politics of silence (detectable in both Virilio and the acoustic ecology movement) is that both tend to restrict sonic intensity to the confines of a directly proportional relation to loudness or fastness instead of engaging the more complex affective profile of frequency dynamics and the polyrhythmic composition of speeds and slownesses. A rhythmanalytic method is preferable here to the dromology of the Marinetti-Virilio axis. It would note vibratory coalescence marked by a more "complex relation between differential velocities, between deceleration and acceleration of particles" rather than the fetishization or critique of the nexus of noise and speed.[12]

1989: Apocalypse Then

11

The future is better protected than the past.
—Chris Marker, *La Jetée* (1962)

The futurist legacy, the art of war in the art of noise, aside from widely debated questions of its cryptofascism, misogyny, and contemporary influence on a sonic avant-garde, is, in addition, chrono-strategically compromised. The future it wishes to speed off into rests on a unilinear notion of history, of technological progress and the enhancement of the human condition by prosthetic appendages. Man, for futurism, is not truly mutated, but is only upgraded in a white, metalicized übermensch. The futurist legacy has usually meant "white noise." Meanwhile, the Afrofuturist version of this futurist tendency, especially as formulated by Kodwo Eshun, remains the most compelling surviving strain. Notably, here, the focus for Eshun crucially shifts from noise to the futurhythmachine and from fastness to a complex ecology of speeds. This spectral presence of the futurhythmachine haunts the this book. Eshun's mutation of futurism immediately moves it to a much more sophisticated temporality, polyrhythmic instead of unilinear, a cyclical discontinuity in which there is a virtual coexistence of both the past and the future in the present.

The sonic processes and fictions referred to under the umbrella of Afrofuturism often operate themselves in the preemptive domain and are peppered by the generation of time anomalies, memories of the future, reverse causalities, and future feedbacks epitomized by the line from *Public Enemy*'s 1989 track,

Welcome to the Terrordrome, "Apocalypse bin in effect," reflecting the sentiment that "slavery functioned as an apocalypse experienced as equivalent to alien abduction."[1] More compelling than the straight line to the future of the modernist avant-garde, Afrofuturism often tries to conjure up an achronological nexus whereby sonic experience is riddled by symptoms of dyschronia. The model for this temporal intervention exists in condensed form in its approach to rhythm. The futurhythmachine, serving as a model, constitutes an "artificial discontinuum" that is driven by the impetus to "design, manufacture, fabricate, synthesize, cut, paste and edit."[2]

Afrofuturism takes sonic futurism beyond a preoccupation of noise toward rhythm. More than the futurist rhetoric of noise, for Eshun, it is the rhythmachine that motivates and underscores the musics of the Black Atlantic. The rhythmachine is an algorithmic entity that abducts bodies, modulating their movements. The rhythmachine lies between the beats, or is the glue that congeals individual intensities together. To be abducted by the rhythmachine is to have the sensory hierarchy switched from the perception of rhythmelody to texturhythm, becoming a vibrational transducer, not just a listener. The rhythmachine constitutes a sensual mathematics, whose counting systems and algorithmic procedures take place across the skin. The skin, therefore, for the "rhythmatician," is a skin that thinks. For this reason, Eshun challenges the beatless cliché of futuristic music for reimposing a "pre-industrial sensory hierarchy that shut up your senses in a Cartesian prison." For him, the rhythmachine confounds in advance laments from the likes of Brian Eno when he complained that the problem with computers was that they did not contain enough "Africa" in them.[3]

At the same time, Eshun adopts many of the signature aims of futurism in his concern for the rewiring of sensory technologies to both mutate perception and synthesize new modes of thought. So futurism is taken as an escape pod from "tradition; instead it dislocates you from origins. It uproots you by inducing a gulf crisis, a perceptual daze rendering today's sonic discontinuum immediately audible. . . . The Futurist producer can *not* be trusted with music's heritage" because, for her, the "future is a much better guide to the present than the past."[4] Eshun later suggests that despite appearances, Afrofuturism does "not seek to deny the tradition of counter memory. Rather, it aims to extend that tradition by reorienting the intercultural vectors of Black Atlantic temporality toward the *proleptic* as much as the retrospective."[5] The reason for this is the now preemptive mode of security. Speculative power, he argues, "functions through the envisioning, management, and delivery of reliable futures."[6] He notes how the

futures industry functions "to fuel the desire for a technology boom," and in this sense, "it would be naïve to understand science fiction, located within the expanded field of the futures industry, as merely prediction into the far future, or as a utopian project for imagining alternative social realities"[7] but rather, in William Gibson's terms, to "pre-program the present," or, for Samuel Delaney, to "significantly distort it."

Instead of the avant-garde of the early twentieth century, following Toni Morrison, Eshun insists that it was the "African slaves that experienced capture, theft, abduction, and mutilation [who] were the first moderns."[8] The tactic of the Afrofuturist artist and musician therefore is to "alienate themselves from sonic identity and to feel at home in alienation" because, as Tate and Eshun agree, Afro-diasporic "subjects live the estrangement that science fiction writers envision. Black existence and science fiction are one and the same."[9] This future is always prismatic, usually characterized by an oscillation between preindustrial Africa and scientific Africa in a cyclically discontinuous loop. African sonic process becomes a telecommunications medium operating through a vast transcontinental and transtemporal web: a rhythmic cyberspace that predated the Internet by decades. In *The Last Angel of History,* the protagonist is adrift in this web, like the main character from Chris Marker's *La Jetée,* searching for the "distributed components of a code to a black secret technology that is the key to a diasporic future."[10]

Forcing sonic futurism into contact with both critical and speculative science fiction as a means to diagnosing contemporary preemptive power, Eshun suggests that Afrofuturism's key intervention is directed toward those cybernetic futurisms that talk "of things that haven't happened yet in the past tense" and thereby seek to "model variation over time by oscillating between anticipation and determinism."[11] Such a science fiction capital, as Mark Fisher has described it, produces feedback circuits that actualize desired futures within the passing present. Against this backdrop, Eshun understands Afrofuturism's core insight as being precisely to pinpoint, combat, and subvert those predatory futurologies of science fiction capital that trap Africa, and its diaspora's future in a demoralizing doomsday of forecast archetypal dystopia, usually economic, ecological, or epidemiological, or some combination of these. As he notes, the "density of dystopic" future casting of Africa is extreme. Afrofuturism therefore targets the "dimension of the predictive, the projected, the proleptic, the envisioned, the virtual, the anticipatory and the future conditional" and "the articulation of futures within the everyday forms of the mainstream of black vernacular

expression."[12] It is within this context that *Sonic Warfare* moves beyond traditional notions of futurism. The conception of the art of war in the art of noise is replaced by a rhythmanalysis of preemptive power, a cartography of diasporic bass cultures[13] and their transduction of ecologies of dread, and an investigation of the concept of audio viruses that Afrofuturist musics and fictions have created. In this weird climate, where control competes with aesthetics in the speculative domain, only one thing is clear. As Whitehead wrote in *Science and the Modern World,* "It is the business of the future to be dangerous."[14]

1738: Bad Vibrations

12

Ring me alarm and not a sound is dying
ring me alarm and not a sound is sufferin'. . . .
Watch de sound man a-tremble
Watch de sound man a-pray.

—Tenor Saw, "Ring De Alarm"

In *The Ecology of Fear,* Mike Davis challenges the stereotype of the futuristic, high-tech city of control as modeled on the cinematic city of *Blade Runner.* He refers us instead to Octavia Butler's *Parable of the Sower,* set in 2024, as a model of low-tech, low-rise, sprawl urbanism closer to the reality of the planet of slums in which everyone is left to fend for themselves.[1] As Davis has argued in other work, this ecology of fear converges with a mutation in the mode of control as a new cartography of danger. Transecting the nature/culture continuum, from floods to criminality, terrorism to viral outbreaks, hurricanes to plane crashes, the ecology of fear transforms urban design through increasingly preemptive logics revolving around fuzzy threats whose archetype is viral.

Davis produces a diagram to illustrate the ecology of fear. It is based on a revision of the classic sociological model of twentieth-century urban growth developed around the specific situation of Chicago, the Burgess model. To the socioeconomic determinants of income, land value, class, and race, Davis adds the affective tonality of fear into the equation. Supplementing this classical model with his own observations on Los Angeles, he notes how "security measures are

reactions to urban unrest . . . a riot tectonics that episodically convulses and reshapes urban space."[2] In the "continuing erosion of the boundary between architecture and law enforcement," a sonic architecture of control is also emerging, with "loudspeakers warn[ing] trespassers that they are being watched and that authorities are on their way."[3] Moreover, the "sensory systems of many of Los Angeles's new office towers already include panopticon vision, smell, sensitivity to temperature and humidity, motion detection, and, in a few cases, hearing."[4] Vigilant control is no longer merely panoptic but pansensory.

Davis's serial tales of doom have been at the forefront of tracking a seeping military urbanism that enforces segmentation and mitigates against social "promiscuity (that 'intimacy of strangers of all classes')" by actualizing sociological categories into modulation filters determining access via checkpoints, gated boundaries, and other means. But it is worth lingering over the addition of the fear factor into the diagram of the control city. The "fear factor" signifies both a generalized existential condition and a particular set of psychophysiological behaviors.

As a generalized condition, many have begun to argue that the virtual architecture of dread defines the affective climate of early-twenty-first-century urbanism. Conventionally construed in religious terms as an existential awe in the presence of the divine, qualitatively distinct from fear in its tremendous profundity,[5] it now arguably designates the ontogenetic base of contemporary geostrategy. It is underpinned by the feeling, as a character from William Gibson's novel *Pattern Recognition* proclaims, that "we have no future because our present is too volatile."[6] This looming feeling of uncertainty coincides in novel ways with the logic of preemptive power, producing an affective jitteriness and speculative foreclosure, the inability to think differently as control co-opts science fiction. Virilio, in his increasingly gloomy mode of address, laments the manner in which modern art appeases this climate of anxiety. In *Art and Fear,* for example, he continues his critique of futurism for installing both the art of war and the art of noise at the heart of modernism, leading to, in the polymedia age, the ever increasing and oversonorization of the visual. For Virilio, a sonic war has been launched on art, threatening to kill it. And this sonic war forms a microcosm, for him, of the "silencing of silence" in a loudness war of "shock and awe." For Virilio, this antinoise lament and the politics of silence it implies, in tandem with his diatribe against speed, forms part of his consistent antifuturist polemic.[7] But before concurring too swiftly with such reactionary sentiments,

it is worth delving into the workings of the affective sensorium,[8] inquiring how fear is induced as a sonic effect.

Virilio's complaint resonates with that of Joachim Ernst-Berendt's in his depiction of the sonic call to arms:

> As soon as volume exceeds 80db, blood pressure rises. The stomach and intestine operate more slowly, the pupils become larger, and the skin gets paler—no matter whether the noise is found pleasant or disruptive, or is not even consciously perceived. . . . Unconsciously we always react to noise like Stone Age beings. At that time a loud noise almost always signified danger. . . . That is therefore pre-programmed, and when millions of young people hear excessively loud music they register: danger. They become alarmed. That word comes from the Italian Alarm, which in turn leads to all'arme, a call to arms. When we hear noise, we are constantly—but unconsciously—"called to arms." We become alarmed.[9]

Sound is often understood as generally having a privileged role in the production and modulation of fear, activating instinctive responses, triggering an evolutionary functional nervousness.

The power of sound to instill dread was well known to the heavily outnumbered Maroons, the tribal nation turned guerrilla fighters who claimed a number of astounding victories in their asymmetric conflict with the English colonialists in Jamaica during the late eighteenth century. The abeng, a fashioned cow horn, had two uses: by slave holders to call the slaves to the cane fields and a "traditional form of communication among the communities, warning them and sending messages across difficult terrain."[10] The Maroons used the abeng in tandem with their other special techniques—drum communication, the ambush, and camouflage—in order to outwit the British: "They embedded themselves in leaves and vines and melted into the surrounding bushes. The British repeatedly walked into clearings where their surroundings would suddenly come alive and close in on them."[11] The abeng, as a system of communication, produced signals "reproducing the pitch and rhythmic patterns of a fairly small vocabulary of Twi words, from their mother language, in most cases called Kromantin (Maroon spelling) after the Ghanaian port from which many slave ancestors were shipped."[12] Sentries stationed outside the villages would use the different pitches to communicate the British approach, the extent of the weapons they carried, and their path. But the abeng also had another affective function: to scare the British with its "hideous and terrible" dislocated tones, sometimes managing to repel the invaders with sound itself. Gradually, as the

British learned to assign a cause to its shrieking, high-pitched sound, their terror of Maroon ambush only intensified.

The viscerality of film and media generally, and sound specifically, is certainly a common perception, if somewhat lazily and undertheorized.[13] Low-frequency infrasonic tones are also said to be especially effective in the arousal of fear or anxiety and "bad vibes." In 2002, the brutal French film *Irreversible,* directed by Gaspar Noe, was released, loaded with ultragraphic sexual violence and a disorienting temporality to ensure maximum effect. In addition to the intense viscerality of the visuality of the film, its sonic dimension magnified the nauseous tone. The director stated in an interview that the music for the film was augmented with infrasound, particularly the sound effects used by police to quell riots by inducing slight nausea: "We added 27 Hz of infrasound. . . . You can't hear it, but it makes you shake. In a good theatre with a subwoofer, you may be more scared by the sound than by what's happening on the screen. A lot of people can take the images, but not the sound. Those reactions are physical."[14] Infrasound is inaudible yet felt, and this can frustrate perceptual compulsions to allocate a cause to the sound. Abstract sensations cause anxiety due to the very absence of an object or cause. Without either, the imagination produces one, which can more frightening than the reality.

While the ability to interpret sounds and attribute likely causes to them is learned culturally so as to instruct on the particular danger to each species, it is also argued that this is built on top of an evolutionary hard-wired instinct to respond appropriately, for the sake of survival, to any threat indicated by sound. To prolong survival, it is claimed, the body has developed three basic affects in response to fear: the fight, flight, and freeze responses. These three affects travel down three lines: the line of attack, the line of flight, and the line of fright. Conflict, escape, and immobility. Some commentators have drawn our attention to the contrasting behavior of young humans—how for children, fear comes through the ears rather the eyes. Even as adults, the effects of noise, strange tones, and powerful amplitudes in intensifying terror are facts taken for granted. Take the siren, for example. Invented by Seeback in the nineteenth century, "The siren broadcasts distress. It is a centrifugal sound designed to scatter people in its path"[15] by pulsing waves of nonlinguistic command to disperse a population. A siren obviously signifies alarm, but more interestingly here, its very modulation of frequency produces a state of alert that can undermine and override cognition. Burglar alarms, ring tones, alarm clock, fire alarms: a whole directly affective asignifying semiotics of emergency, a call to action, the inducement

of a state of readiness, initiating a kind of technical antiphony. Wake up! Run! Beware! Respond! Act!

In evolutionary terms, it is taken for granted that the imperatives of the survival of the organism demarcate the primary function of the auditory system. Second-wave cyberneticist Heinz Foerster suggested that the auditory system is served by biological means "to infer from the sounds that are perceived the sources that produced these sounds. When the sources are identified, more clues relating to the state and kind of its environment are available to an organism, and in a few tenths of a second it may swing from a state of utter tranquility into one of a dozen or two modes of behaviour . . . depending on what is implied by the presence of a particular source."[16]

The story here, the directionality of its chain of events, is a common one that persists into contemporary cognitivist neuroscience: sound—cognitive classification of sound to attribute external source and internal subjective emotion, movement, or activation of the body in response to the emotion. However, this model rests on certain problematic presuppositions regarding the relation between mind and body and their activation, between feeling and emotion. The point of departure for an affective analysis is the disjunction between stimulus and response, cause and effect. If affect operates across the nature-culture continuum, problematizing the difference between what is preprogrammed into the body and what are learned responses, then what is meant by an instinctual response to sound? How are so-called instinctual responses sometimes short-circuited in the intensification of joy? And what happens when there is a more complex, nonlinear array of sensorienvironmental conditions at work, when effects become autonomous from causes, when sounds evacuate their source, when fear becomes self-producing?

1884: Dark Precursor 13

You are sitting calmly minding your own business. Suddenly you hear a sound. Looking around, it seems to be emanating from a source up on the wall in the corner of the room. Checking that it did not signal anything significant, you return to your business of staring intensely at the wall. Suddenly the tone sounds again, but this time, instantaneously, you feel a sharp jolt of pain pulse up from the floor. You freeze with shock, until the moment the sound, the pain, passes. What the hell? Just as you are regaining your composure, the sound starts again. Without thinking, you freeze, as if shocked again, but you eventually notice that that shooting pain is not there. What happened? You're a rat, have been fear conditioned, and Pavlov is probably sitting around the corner.

In his book *The Emotional Brain,* Joseph Ledoux discusses the neuroscience of the sonic activation of fear in a manner that owes much to William James's classic 1884 formulation, but also the behaviorism of Pavlov. In summary, Ledoux is interested in how cognitive faculties are short-circuited in the process of activation and how a conscious emotion is unnecessary in producing fear responses. Ledoux discovers through his experiments that the higher cognitive faculties of the auditory cortex do not need to be engaged for fear responses to be engaged. Rather, stimuli are routed straight from the thalamus lower down in the brain to the amygdala, which he discovered was sufficient to elicit "freezing behaviour, autonomic responses, suppression of pain, stress hormone release, and reflex potentiation."[1] While the thalamic system cannot make the qualitative

distinctions that the auditory cortex can, it is much quicker. Ledoux concludes that in fact, the higher cognitive functions of the cortex merely serve as filters for decisions already made, subtracting some, complying with others. Although this is a powerful analysis, Ledoux is weaker on issues such as the transduction of fear, sounds that are in themselves painful as opposed to just being associated with pain, and also seems to have a somewhat misleading notion of the auditory channel as a frictionless relay of undisturbed information.

Nevertheless, his formulation of this Jamesian legacy of affective neuroscience is crucial. This legacy is also taken up and extrapolated in a series of essays on fear and preemption by Brian Massumi dating back to the 1990s. The fear response becomes a kind of model of temporality generalizable, to pry open the intricate relations between virtual power, affect and futurity. The body's autonomic, behavioral, and emotional responses to ontological insecurity have always exceeded commonsense formulas, and Massumi draws from a line of affective thought that stretches from Spinoza through William James and onto Whitehead to take us elsewhere. Instead of essential instincts, we have what Spinoza called the appetites: a body's conatus, or striving to persist in its power to affect and be affected, its potential. Whereas instinct usually denotes a closed, preprogrammed system with no room for change, appetite is future facing and always in conjunction with the body's relation to a shifting ecology, its open-ended relationality.

The rhythm of events that an affect-centric theory maps is configured differently from that of cognitivist neuroscience and is closer, though not always identical to, the formulations of Ledoux and Damasio. For Massumi, the sonic activation of the affective sensorium produces a basic autonomic response: "As you cross a busy noonday street, your stomach turns somersaults before you consciously hear and identify the sound of screeching brakes that careens towards you. . . . The immediacy of visceral perception is so radical that it can said without exaggeration to precede the exteroceptive sense perception. It anticipates the translation of the sight or sound or touch perception into something recognizably associated with an identifiable object."[2] In this example of visceral perception initiated by the sound of the screeching brakes, the plunging stomach marks the incipience of the line of flight, its preacceleration.[3] Here also the threat, active nonconsciously in advance, of impending doom, is backed up by the sheer metallic tonnage of the incoming vehicle. In the sense identified by William James in his psychology of fear,[4] autonomically the body makes the

decision to act, with the emotion and corollary conscious decision to act being merely a retrospective description of the feeling of the body's decision.

In the ecology of fear, however, threat becomes spectral. Effect becomes autonomous from cause. Unlike earlier modes of management of the future such as deterrence, preemptive security does not prevent but rather induces the event, no longer warding off its arrival in a negative anticipation; preemption positively actualizes the future in the present, or at least the effects of events yet to come, to the extent that the cause of the effects, that is, the event, need not necessarily happen. The effects are real, a real and present danger, while the event as cause, or quasi-cause as Massumi describes it, is virtual, a real and future-past danger. That the effects are real compels security to act on the level of virtual threat, responding to the actualization and perpetuating an ecology of fear. This actualization catalyzed by preemptive security involves the production of the signs of alarm as a response to threat, producing a readiness through inducing fear. By taking action in an unpredictable environment, security inserts a minimal dose of surety, a fear that has already been secured in advance. The fear becomes autonomous and escalative, a self-fulfilling, self-effecting prophecy: "Threat triggers fear. The fear is of disruption. The fear is a disruption."[5] In this ecology, the micropolitics of sonically signaling threat attains a reenergized significance. Both operating under and percolating through the mesh of language—from radio to rumor to terror alert sirens on megalopian transport infrastructures—the sound of the alarm functions as an index of this paradoxical, self-actualizing threat. In preemptive modes, the sign of the event no longer has to wait for the anticipated event. The sound in fact beckons the event. The vibrations of the alarm literally set the affective tone, the collective mood. What is edginess, nervousness, or the jitters if not the potential of vibrations to spiral into goalless, open-ended hyperactivity?

This intensified viscerality of power requires an analysis operating on the preindividual plane of affect, in the turbulent boundary layer between subjective experience and the world, where virtual threats have real effects. Such modes of control modulation operate impersonally. A veneer of cognitive processing and phenomenological subjective agency therefore only conceals power's real pressure points. As Massumi forcefully argues, preemptive power addresses "bodies from the dispositional angle of their affectivity, instead of addressing subjects from the positional angle of their ideations, shunt[ing] government function away from the mediations of adherence or belief and toward direct activation."[6]

It signals, he continues, a mode of governmentality that can "possess" an individual through the emission of sign-acts. The human actor triggering an alarm merely plays a catalytic role, enveloped in a self-effecting networked agency. In such a capillary network, the sonic security nexus is subject of the event, and the induced collective fear is object. Such a network effects bodily actions as a by-product of affective activation.

In Massumi's theory, which is the most sophisticated synthesis of such approaches, the affective tonality of the fearful encounter precedes its bifurcation into subject and object. In the onset of the event, the body-environment acts as one, with an immediate continuity of the extensive movement of the body and the intensive affect of fear. The vector of the event, in its unfolding, passes down the line of flight, pulling the environment into its slipstream. The event bifurcates. The action ceases, its movement dissipated. The vortical blur of fearful movement congeals into the stasis of segmented, objective space, scanned for potential weapons or to retrospectively attribute causes to effects. What happened? Meanwhile the affect continues to unravel further, becoming distinct, finally as a feeling of fear. The fearful feeling that animated the whole unfolding becomes the feeling of fear: from experience being imminent to the fearful event, to the fear as emotional content of the experience. As the event unfolds, it is interiorized and domesticated and passes from the nonphenomenal to the phenomenal. The continuous, qualitative, intensive vector of affective tonality is chopped up into comparable, relative, numbered magnitudes (more or less frightened). In parallel, then, as affect becomes emotion, sensation becomes perception and movement finds pause. The fearful feeling becomes a feeling of fear. The noisy feeling becomes a feeling of noise. Sensing becomes hearing. A movement of the body becomes a movement of thought becomes a movement of the body—a whole rhythmanalysis of the affective sensorium under sonic activation—the body as transducer of affective tonality, sensing as the qualification of affective tone, and perception as the quantification of affective tone. The conscious classification of an affective pitch or vector of feeling into attributable sounds is preempted by amodality, therefore preceding the designation of a sensation to a specific exteroceptive sensory channel. In this sense, the sonic encounter does most of its affective work before cognitive appropriation by the sense of audition.

Bearing in mind the affective disjunction between causes and effects of fear, Virilio is way too quick to condemn the sonorization of art for complicity with "shock and awe," for appeasing and reinforcing the ecology of fear. While the

ecology of fear is a virtual factory for the production of existential anxiety, the exorcism of this dread, through its preemptive production, has been a central objective of affective hackers. In the late twentieth century, urban machine musics in their sonic sciences of affective contagion have preoccupied themselves with generating soundtracks to sonically enact the demise of Babylon, mutating the early-twentieth-century concerns of audio futurism (war, noise, speed and sensation) into the construction of ephemeral, mutant, sonic war machines. As Kodwo Eshun has described it, music in a condition of sonic dominance often thrives on the scrambling of instinctual responses: "Your fear-flight thresholds are screaming, it's like your whole body's turned into this giant series of alarm bells, like your organs want to run away from you. It's like your leg wants to head north and your arms want to head south, and your feet want to take off somewhere else. It's like your entire body would like to vacate. Basically, you want to go AWOL, from yourself. But you can't, so you stay and enjoy it."[7]

The mechanics of film sound design are also revealing. In the cinematic experience, the frisson that acute fear produces—the sensation of chills, waves of shivers up and down the spine, goose bumps and hairs standing on end (piloerection)—is actively pursued. The interplay of fear and threat is evoked by narrative tactics of tension such as suspense, a gradual buildup through delaying the arrival of the event whose occurrence resolves the tension, and surprise, working on the effect of the unexpected, the unforeseen, a shock. Film sound modulates affect by tapping into and rewiring the line of attack, the line of flight, and the line of fright. The mechanics of the aesthetization of fear within music and sound design already gives clues to some tactics for channeling the negative energies of the ecology of fear, confiscating them from the architectures of security. Neither Virilio's lament on the sonification of art nor Mike Davis's total dystopias leave much room for such deployments. While sonic mood modulation becomes another dimension of the ambiences of control, it would be foolish to ignore the complex affects of the ecology of fear for the sake of a too hasty politics of silence. At very least, the transduction of bad vibes into something more constructive suggests the need to probe more deeply into affective tonality and the vibrations of the environment.

14 1999: Vibrational Anarchitecture

Neo-Tokyo.

An elaborate terrorist plot is staged, stringing together an infovirus, architectural vibration, and inaudible frequencies to catalyze a revolt of machine slaves and bring down the towers of the Babylon Project. The sinister plot was to hack into and infect the operating system of the 8,000-strong, Transformer-like, robotic police force (the patrol labors, or Patlabors for short). When two cops were sent out to investigate an unexplained wave of rogue Patlabors rampaging across the city, they uncover the sinister revenge plot to infect the city's population of labors with the BABEL virus. This computer virus in the Hyper-Operating System could be triggered only by a very specific frequency of sound. This tone, a high-pitch whistle, is emitted only by the sympathetic vibrations generated by the resonating skyscrapers of the Babylon Project as it channels, like a huge tuning fork, the winds of a massive tropical typhoon. The whistle is inaudible to humans but not to the cybernetic audio sensors of the Patlabors, which are much more sensitive. If unleashed, the virus threatens to spread across the robots, forcing them to defect, mutating them into terrorists, and causing the population to descend into panic-stricken chaos.

Patlabor, a slice of Japanese animation from 1989, describes a city whose future hangs in the balance, permanently on the brink of dystopia. The immanent threat of meltdown is set up with a delirious complexity at which Manga typically excels. A number of features make this crazed yet weirdly prophetic science fiction of interest here. First, the vibrational architecture of the city becomes a

weapon. The city is no longer merely the site of warfare but, as a result of the resonant frequency of the built environment, the very medium of warfare itself. Using emitted tones as a chance triggering device, the plot tunes into the city as an instrument, not just venue, of terror. Second, in its imagination of disaster, this scenario is properly ecological in a manner befitting the conflicts of the twenty-first century. It sketches an ecology no longer confined to the "natural" and the organic, but rather one that encompasses the climatic, the artificial environment of the urban, and the affective drift of the city's inhabitants. It is an ecology in which volatile processes in one milieu transfer their energy into volatile processes in another milieu, from typhoon, to architectural resonance, to infovirus, to robot revolt, to the fear of population turbulence. Third, in the Babel virus, Patlabor indicates that the virus, whether biological, computer, or affective, is the abstract model of threat in cybernetic control societies. Finally, audition has been upgraded. This is a cybernetically upgraded mode of perception in which the bandwidth of hearable frequencies has been technically expanded.

What if, however, the shifting relation between the audible and the inaudible was not merely a matter of technical upgrades to the human sensorium but rather indicated a kind of policing of frequency that distributes that which is sonically sensed? In *Patlabor,* moreover, the emitted frequency was merely a switch, triggering the technical cascade of the weapon: the computer virus tagged Babel. But what if the actual weapon was vibration itself, and its target not the operating systems of robots but the affective operating system of the city's population? This would be a scenario in which that which was being transmitted would be not just information but bad vibes. In this ecology, an event would simultaneously draw in the physics of its environment (its vibrations) and the moods of its populace (its vibes), sending an immense collective shiver through the urban as resonating surface.

The work of American artist Mark Bain draws attention to the primacy of vibration in any discussion of sound, affect, and power. Bain is a vibration artist. He repurposes military and police research into infrasonic and ultrasonic weaponry intended as crowd control devices in order to create an ethico-aesthetic intervention into the resonant frequency of objects and the built environment. He deploys infrasound, that is, sounds at frequencies below the threshold of hearing, to investigate the unpredictable effects on movement, sensation, and mood. For example, a typical occurrence related to vibration is its effect on the vestibular system and the sense of orientation in which balance can be modu-



lated so that suddenly your perception is, as Bain describes it, that of "surfing the architectural plane."[1]

As opposed to a sound artist, he describes the sonic effects of his work as side effects, or artifacts, merely an expression of a more fundamental subsonic vibrational ecology.[2] Bain seeks to tap into a "secret world of sound resident within materials. Using multiple oscillators . . . it becomes more like an additive synthesis type of production." He unleashes the contagiousness of vibration in the production of a "'transient architecture' that describes a system of infection where action modulates form . . . where stability disintegrates" and effects are "re-injected into the walls of the 'host' site" in a "translation of sorts, one building's sound infecting another."[3]



Influenced by and mutating Matta Clark's notion of *anarchitecture,* Bain has referred to his work as both "massaging buildings" and a kind of "architerrorism."[4] In one of his more recent pieces, he turned the seismological data recorded from the September 11 attacks into a musical composition, using data gathered from a Columbia University listening station located 21 miles north of New York City. Bain was fascinated by what he called the "screamingness of the earth," its countless, constantly active, inaudible pulsing and vibration. In addition to collating seismological information, increasing its frequency range, amplifying its volume, and stretching it out in time to render it audible, Bain's research has revolved around a series of installations such as *The Live Room,* in which he attaches oscillators to buildings to make them resonate, the sounds enveloping and immersing the audience. This trembling envelope, Bain argues, produces a vibrational topology or "connective tissue" between one building and another and the bodies in attendance.[5]

Bain's work resonates with Augoyard and Torgue's call in *Sonic Experience* for the audible city to be understood less in terms of sound objects and the soundscape but rather as an *instrumentarium.*[6] He notes that "one of the things that is interesting about the building being sized so large: when I am putting energy into it, it acts as a radiator, or a speaker in a sense. The surfaces are rattling and vibrating out. What you hear is the movement of the building. Most of it is subsonic though, and it has this heaviness that relates to the heaviness of the architecture. I like this massiveness of the sound."[7]



If the built environment is frozen music, then the freeze occurs in both the folding of tectonics into architectonics and of vibration into organized sound or music. Architecture is designed to withstand a spectrum of vibrational strains, from the accident of the earthquake to the infrasonic infrastructure produced

by hydraulic channels, ventilation shafts, and reverberations of passing traffic. A bass materialism or vernacular seismology returns the vibrational event of liquefaction back to the city. It promotes an anarchitecture that is no longer merely deconstructive in style, but rather experiments with sonic liquefaction, where interior and exterior and discreet entities are unfolded onto a continuum of differential vibration. The concrete ripples and pulses with invisible vortical force fields. Objects become vectorial, simultaneously projectile and contagious, defying gravity, sliding across horizontal surfaces. The air becomes heavy, and metal screams under the torque. Liquids become turbulent; vortices emerge. But aside from these physical interventions, this anarchitecture also modulates affective tonality and mutates ambience. The weightless, perfumed music described by Brian Eno congeals in the dread, heavy space of a drowned world. The city submerged in an infrasonic soup—a contagious swamp of rumbles, gurglings, and murmurs. A reservoir of potential.

A vibrational anarchitecture occupies a topological mediatic space that cuts across the plexus of the analog and the digital, their nested intertwining. The conception of a vibrational topology can be approached initially through cymatics and the experimental work of Hans Jenny. Cymatics revolved around the way in which materials, objects, and entities affect and are affected by vibration and the way rhythmic motion can become apparent in static objects as well as in moving objects, producing not just patterns but forms continuous with the vibrational environment. Looking at the effects of oscillation, gradients, and fluctuation on media by passing viscous substances through vibrating of magnetic fields, Jenny was able to speculate on the generation of structures implicated into the environment. When experimenting with the generation of special sonorous patterns in a liquid metal such as mercury, he noted the formation of wave patterns, vortices, and other hydrodynamic phenomena. For Jenny, cymatic observation focused on "the rhythmic beat, the circulation, the ever recurrent rotations" and the way such substances "always present themselves as a whole entity which *at the same time* oscillates, vibrates, flows within itself, pulsates and moves to-and-fro. . . . Such turbulences are of particular interest in that they render the environment sensitive to the effects of sound."[8] Cymatics therefore provides an initial model for an ontology of vibrational force based on analog wave phenomena. However, other approaches are required to those based in analog continuity to conceptualize the status of vibrational force and its coding within digital culture.





From cymatics to the vibratory anarchitecture practiced by artists such as Mark Bain, the vernacular seismology and sonic dominance practiced by the bass materialists of the musical diaspora of Jamaican sound system culture,[9] a set of experimental practices to intensify vibration has been developed for unfolding the body onto a vibrational discontinuum that differentially traverses the media of the earth, built environment, analog and digital sound technologies, industrial oscillators, and the human body. Each actual occasion of experience that populates this discontinuum will be termed a *vibrational nexus,* drawing in an array of elements into its collective shiver.

This differential ecology of vibrational effects directs us toward a nonanthropocentric ontology of ubiquitous media, a topology in which every resonant surface is potentially a host for contagious concepts, percepts, and affects. In this speculative conception of ubiquitous media, not just screens (and the networks they mask everywhere) but all matter becomes a reservoir of mediatic contagion.[10] By approaching this topology of vibrational surfaces without constraint to merely semiotic registers that produce the "interminable compulsion" to communicate, media themselves are allowed to become fully expressive. An outline of a vibrational anarchitecture,[11] then, diagrams a topological mediatic space that cuts across the plexus of the analog and digital, the waveform and the numeric sonic grain, implicating the continuity of the wave into the atomism of the granular. It will be argued that the quantum field of this vibrational anarchitecture constitutes the most elementary battlefield of sonic warfare and the microtexture of its weapons and targets.

This ontology of vibrational force is constructed through bass materialist research concepts and practices. Bass figures as exemplary because of all frequency bands within a sonic encounter, it most explicitly exceeds mere audition and activates the sonic conjunction with amodal perception: bass is not just heard but is felt. Often sub-bass cannot be heard or physically felt at all, but still transforms the ambience of a space, modulating its affective tonality, tapping into the resonant frequency of objects, rendering the virtual vibrations of matter vaguely sensible. Bass demands more theoretical attention, as it is too often equated with a buzzing confusion of sensation and therefore the enemy of clear auditory perception and, by implication, clear thought. But for many artists, musicians, dancers, and listeners, vibratory immersion provides the most conducive environment for movements of the body and movements of thought.

13.7 Billion B.C.: The Ontology of Vibrational Force 15

That humming background sound is ancient—the ringing of a huge bell. Exploding into a mass of intensely hot matter, pulsing out vast sound waves, contracting and expanding the matter, heating where compressed, cooling where it was less dense. This descending tone parallels the heat death of the universe, connecting all the discrete atoms into a vibrational wave. This cosmic background radiation is the echo of the big bang.

Outlining the affective micropolitics of sonic warfare demands a specifically tuned methodology. Drawing from philosophy, cultural studies, physics, biology, fiction, and military and musical history, an ontology of vibrational force can be pieced together that traverses disciplines.[1] An ontology of vibrational force delves below a philosophy of sound and the physics of acoustics toward the basic processes of entities affecting other entities. Sound is merely a thin slice, the vibrations audible to humans or animals. Such an orientation therefore should be differentiated from a phenomenology of sonic effects centered on the perceptions of a human subject, as a ready-made, interiorized human center of being and feeling. While an ontology of vibrational force exceeds a philosophy of sound, it can assume the temporary guise of a sonic philosophy, a sonic intervention into thought, deploying concepts that resonate strongest with sound/noise/music culture, and inserting them at weak spots in the history of Western philosophy, chinks in its character armor where its dualism has been bruised, its ocularcentrism blinded.

The theoretical objective here resonates with Kodwo Eshun in *More Brilliant Than the Sun* when he objects to cultural studies approaches in which "theory always comes to Music's *rescue.* The organization of sound interpreted historically, politically, socially. Like a headmaster, theory teaches today's music a thing or 2 about life. It subdues music's ambition, reins it in, restores it to its proper place."[2] Instead, if they are not already, we place theory under the dominion of sonic affect, encouraging a conceptual mutation. Sound comes to the rescue of thought rather than the inverse, forcing it to vibrate, loosening up its organized or petrified body. As Eshun prophetically wrote at the end of the twentieth century, "Far from needing theory's help, music today is already *more* conceptual than at any point this century, pregnant with thought probes waiting to be activated, switched on, misused."[3]

An ontology of vibrational force objects to a number of theoretical orientations. First, the linguistic imperialism that subordinates the sonic to semiotic registers is rejected for forcing sonic media to merely communicate meaning, losing sight of the more fundamental expressions of their material potential as vibrational surfaces, or oscillators.



Despite being endlessly inspired by intensive confrontation with bass frequencies, neither should an ontology of vibrational force be misconceived as either a naive physicalism in which all vibrational affect can be reduced scientifically. Such a reductionist materialism that merely reduces the sonic to a quantifiable objectivity is inadequate in that it neglects incorporeal affects. A concern for elementary vibrations must go beyond their quantification in physics into primary frequencies. On the other hand, the phenomenological anthropocentrism of almost all musical and sonic analysis, obsessed with individualized, subjective feeling, denigrates the vibrational nexus at the altar of human audition, thereby neglecting the agency distributed around a vibrational encounter and ignoring the nonhuman participants of the nexus of experience.





Rather, it is a concern for potential vibration and the abstract rhythmic relation of oscillation, which is key. What is prioritized here is the in-between of oscillation, the vibration of vibration, the virtuality of the tremble. Vibrations always exceed the actual entities that emit them. Vibrating entities are always entities out of phase with themselves. A vibratory nexus exceeds and precedes the distinction between subject and object, constituting a mesh of relation in which discreet entities prehend each other's vibrations. Not just amodal, this vibrational anarchitecture, it will be suggested, produces the very division between subjective and objective, time and space.



If this ontology of vibrational force can help construct a conception of a politics of frequency, then it must go beyond the opposition between a celebration of the jouissance of sonic physicality and the semiotic significance of its symbolic composition or content. But enough negative definitions.

If affect describes the ability of one entity to change another from a distance, then here the mode of affection will be understood as vibrational. In *The Ethics,* Spinoza describes an ecology of movements and rest, speeds and slownesses, and the potential of entities to affect and be affected.[4] This ecology will be constructed as a vectorial field of "affectiles" (affect + projectile), or what William James refers to as pulsed vectors of feeling. As an initiation of a politics of frequency, it resonates with the ballistics of the battlefield as acoustic force field described by the futurists. This vectorial field of sonic affectiles is aerodynamic, but it can also be illuminated by rhythmic models of liquid instability that constitute a kind of abstract vorticism.

This vibrational ontology begins with some simple premises. If we subtract human perception, everything moves. Anything static is so only at the level of perceptibility. At the molecular or quantum level, everything is in motion, is vibrating. Equally, objecthood, that which gives an entity duration in time, makes it endure, is an event irrelevant of human perception. All that is required is that an entity be felt as an object by another entity. All entities are potential media that can feel or whose vibrations can be felt by other entities. This is a realism, albeit a weird, agitated, and nervous one. An ontology of vibrational force forms the backdrop to the affective agency of sound systems (the sonic nexus), their vibrational ontology (rhythmanalysis), and their modes of contagious propagation (audio virology). In its primary amodality and secondary affinity to the sonic, a discussion of vibrational ecologies also helps counter ocularcentric (modeled on vision as dominant sensory modality) conceptions of cyberspace, contributing to a notion of virtual space that cuts across analog and digital domains.

This ontology is concerned primarily with the texturhythms of matter, the patterned physicality of a musical beat or pulse, sometimes imperceptible, sometimes, as cymatics shows, in some sensitive media, such as water or sand, visible. While it can be approached from an array of directions, the ontology of vibrational force will be explored here by three disciplinary detours: philosophy, physics, and the aesthetics of digital sound. In each, the stakes are fundamental. Philosophically, the question of vibrational rhythm shoots right to the core of an ontology of things and processes and the status of (dis)continuities between

them. In physics, the status of the rhythms of change, the oscillation between movement and rest, plays out in the volatile, far-from-equilibrium zones of turbulent dynamics. While the modeling of turbulence has become the computational engineering problem par excellence for control, within the domain of digital sound design, the generation of microsonic turbulence by the manipulation of molecular rhythms accessible only through the mesh of the digital has become a key aesthetic and textural concern. Each of these fields will be mined to construct a transdisciplinary foundation to the concept of sonic warfare and its deployments of vibrational force.

1931: Rhythmanalysis

16

Rhythmanalysis describes those philosophical attempts to take rhythm as more than an object of study, transforming it into a method. Rhythmanalysis understands both natural and cultural processes in terms of rhythm. It stands as an interesting example where the history of philosophy takes on a sonic inflection, becoming infected by musical metaphors in an attempt to approach something that eludes it. Rhythmanalysis often installs itself ontologically prior to the division of space and time, occupying the domain of intensive matter. According to recent accounts, the term *rhythmanalysis* was invented in an unpublished 1931 text by a Brazilian philosopher, Pinheiro dos Santos. Dos Santos sought an ontology of vibration, where vibration at the molecular, or even deeper at the quantum, level constitutes the fundamental yet abstract movement of matter. This mantle was taken up by French philosopher of science Gaston Bachelard in his 1950 critique of Henri Bergson's concept of continuity, *The Dialectic of Duration*. The chapter entitled "Rhythmanalysis" in Bachelard's text appears to be the most detailed exposition of dos Santos's theory and would prove foundational to Henri Lefebvre's later writings that attempted to move beyond an analysis of the production of space for which he became renowned. Rhythmanalysis, for dos Santos and Bachelard, operates on three levels: physical, biological, and psychoanalytical. Bachelard was keen to avoid a "mystique of rhythm," constructing instead a rhythmic realism.[1] Following dos Santos, he therefore sought to ground rhythmanalysis in early-twentieth-century innovations within quantum physics regarding the particle/wave composition of matter/energy. On a mission

to factor in time to inert conceptions of matter yet in a fashion divergent from Bergson, Bachelard noted that matter

is not just sensitive to rhythms but it *exists,* in the fullest sense of the term, on the level of rhythm. The time in which matter develops some of its fragile manifestations is a time that undulates like a wave that has but one uniform way of being: the regularity of frequency. As soon as the different substantial powers of matter are studied in detail, these powers present themselves as frequencies. In particular, as soon as we get down to the detail of exchanges of energy between different kinds of chemical matter, these exchanges are seen to take place in a rhythmic way, through the indisposable intermediary of radiations with specific frequencies.[2]

Rhythmanalysis here outlines the remit for a vibrational ontology:

If a particle ceased to vibrate, it would cease to be. It is now impossible to conceive the existence of an element of matter without adding to that element a specific frequency. We can therefore say that vibratory energy is the energy of existence. . . . The initial problem is not so much to ask how matter vibrates as to ask how vibration can take on material aspects. . . . It should not be said that substance develops and reveals itself from a rhythm, but rather that it is *regular rhythm* which appears in the form of a specific material attribute. The material aspect . . . is but a confused aspect. Strictly speaking, the material aspect is *realised confusion.*[3]

In deploying rhythmanalysis, Bachelard's theory has interesting implications for a number of philosophical traits that became popular in late-twentieth-century topologically informed philosophy deriving from Bergson. An investigation of some of these divergences is productive in refining the ontology of vibrational force suggested by rhythmanalysis. For Bachelard, it was rhythm and not melody that formed the image of duration. He warned of the misleading application of melody as a metaphor for duration. He wrote that music's action was discontinuous, and it was only its perception that provides it with an appearance of continuity by the employment of an always incomplete and deferred temporal synthesis. For him, this synthesis is what gives, in retrospect, melodic continuity to more or less isolated sonic sensations. By emphasizing rhythm over melody, Bachelard is emphasizing intensity over duration, arguing in fact that duration is merely an effect of intensity, in opposition to Bergson's notion of interpenetration. The endurance of a sonic event, the length of a note, pertains here to a second order and "entails a kind of acoustic penumbra that does not enter into the precise arithmetic of rhythm."[4] In summary, a key principle of Bachelard's "generalized rhythmics" is the "restoration of form. A characteristic is rhythmic if it is restored. It then has duration through an essential dialectic. . . . If a rhythm

clearly determines a characteristic, it will often affect related ones. In restoring a form, a rhythm often restores matter and energy. . . . Rhythm really is the only way of disciplining and preserving the most diverse energies."[5]

Like all good rhythmanalysts, Bachelard asserts the basic rhythmic character of matter in vibration. He shows how physics understands the relation between microrhythmic discord (what he calls the "anarchy of vibrations") and macrolevel stability. Sometimes, however, his emphasis seems firmly placed on rhythmic equilibrium and harmony. For example, he asserts that "when life is successful, it is made of well-ordered times; vertically, it is made of superimposed and richly orchestrated instants; horizontally, it is linked to itself by the perfect cadence of successive instants that are unified in their role."[6] Bachelard, instead of using rhythmanalysis to flatten nature and culture onto a vibratory plane of consistency, constructs a hierarchy of rhythms and elevates organic life over the anorganic: "We shall come to consider living matter as richer in timbres, more sensitive to echoes, and more extravagant with resonance than inert matter is."[7] As a rationalist, he depicts the mind as "master of arpeggio."[8] Yet the question pertains as to why novelty is often produced when rhythms tend toward "far-from-equilibrium" conditions. Moreover, what is the status of the body or, better, the body-mind for this rhythmic methodology?

The concepts of dos Santos and Bachelard were taken up and further developed, expanded, and applied by Henri Lefebvre into what he describes as the "rhythmanalytical project." Following Bachelard's problematic dialectical critique of Bergson's duration, Lefebvre's sense of rhythm is founded on a temporal philosophy of "moments," "instants," or "crises." Crucially, Lefebvre suggested that rhythm perhaps presupposes "a unity of time and space: an alliance."[9] For Lefebvre, rhythm consisted of "a) Temporal elements that are thoroughly marked, accentuated, hence contrasting, even opposed like strong and weak times. b) An overall movement that takes with it all these elements . . . through this double aspect, rhythm enters into a general construction of time, of movement and becoming. And consequently into its philosophical problematic: repetition and becoming."[10]

Usefully Lefebvre generated a concept of the rhythmic body that individuates along the lines of an array of rhythmic compositions such as "isorhythmia (the equality of rhythms) . . . polyrhythmia is composed of diverse rhythms. . . . Eurhythmia . . . presupposes the association of different rhythms [and] . . . arrhythmia, rhythms break apart, alter and bypass synchronisation."[11] However,

while Lefebvre did much to consolidate a philosophy of rhythm, his cursory comments remain somewhat underdeveloped.

Rhythmanalysis, in this fascinating tradition that stretches from dos Santos to Bachelard and Lefebvre, remains problematic for a number of reasons. In each case, the orientation seems too concerned by the equilibrium of rhythmic systems, by their harmonization in a hierarchy of instants. This limitation seems to leave very little room for rhythmic innovation, stifling the potential to think change and the invention of the new. Perhaps this limit points to the core of Bachelard's argument with Bergson in the *Dialectic of Duration.* While Bergson, in *Matter and Memory,* for example, emphasizes continuity in relation to duration, for Bachelard, time is fractured, interrupted, multiple, and discrete. Bachelard's project was to pursue the paradox of a discontinuous Bergsonism: "to arithmetise Bergsonian duration."[12] While for Bergson, the instant represents an illusionary, spatialized view of time, Bachelard wants to prioritize the instant as pure event in a hierarchy of instants. Bachelard argues that in defining duration as a continuous succession of qualitatively different states, Bergson tends to erode the singularity of instants; they merely fade or melt into one another like musical notes. Again, while for Bergson time is visibly continuous, for Bachelard, the microscopic or quantum, that is, invisible, domain of divergences, discontinuities, and vibrations is concealed by the simple movement image. Yet Bergson is thinking of vibration in a very different manner. In *Matter and Memory,* he factored in molecular vibration as that which provides continuous movement to that which appears as static or discrete objects. As Bergson notes, matter "resolves itself into numberless vibrations, all linked together in uninterrupted continuity, all bound up with each other, and traveling in every direction like shivers through an immense body."[13] Once vibrations with frequencies in excess of human perception are acknowledged, Bergson must insist on multiple rhythms of duration to ensure that quality retains priority over quantity. Yet it is exactly these numberless vibrations that Bachelard wishes to arithmetize. This will prove a crucial point of divergence between Bachelard's philosophy of rhythm and Bergsonian theories grounded in continuity. The implications become particularly pointed within debates surrounding the status of the virtual within digital aesthetics. For now, it suffices to say that while Bachelard's insistence on a vibrational ontology is crucial, his reliance on dialectics to reanimate a continuity broken by instants seems to reduce the power of his philosophy of rhythm, relying as it does on polarization over more sophisticated conceptions of relation.

In summary, a rhythmanalytic method potentially offers a foundation for approaching sonic warfare that attempts to sidestep the bifurcation of nature and instead focuses on the fold of the concrete and abstract, the analog and the digital, without the homogenizing sweep that many find in Bergson's continuity of duration, and the analog fetishism of which it is accused. For example, it has become increasingly common, in post-Deleuzo-Guattarian thought, to take flow in itself as the backdrop of the world or, in rhythmic terms, to emphasize the relation between beats at the expense of the event of pulse. This has been an unfortunate emphasis, especially taking into account the machinic conception of the break and flow crucial to the early sections of *Anti-Oedipus* and the role that Bachelard plays in Deleuze and Guattari's theory of rhythm in "Of the Refrain." A route through rhythmanalysis seeks to account for the rhythmic vibration between break and flow, between particle and wave, which postquantum formulations of matter insist on. Yet between Bergson and Bachelard, between duration and the instant, between continuity and discontinuity, a kind of metaphysical deadlock was reached with reverberations that persist into the twenty-first century. For an escape route from this deadlock, it is perhaps necessary to look elsewhere.

1900: The Vibrational Nexus 17

While Bachelard argued that the primary continuity proposed by Bergson drains the concept of the event, moment, or instant of its singularity, it is necessary to go beyond or stretch his conception of rhythmanalysis to be able to conceive of singular thresholds in the vibratory composition of matter at which the propagation of vibration is activated. These intensive vibrations could be conceived of as the *vibration of vibration.* At a certain rhythmic density, a threshold is crossed in the process of individuation, producing a body in excess of its constituent particles, a vortical body out of phase with itself, in tension with its potential, a potential that always exceeds its current actualization. This volatile turbulent nexus, far from equilibrium, is characterized by rhythmic asymmetry more than balance.

The atomistic process philosophy of Alfred North Whitehead offers some kind of route through this standoff between Bergson and Bachelard. If there is a rhythmanalysis implicit in Whitehead's metaphysics, then it pulls in a different direction, accounting for a rhythmic break flow or (dis)continuum, which he refers to as the *extensive continuum.* Whitehead's philosophy intervenes in two directions: first, against the overrationalizations of idealism, and second, against the appeal to raw sensation of currents of empiricism. His process philosophy results in a "transcendental empiricism" or, to use William James's phrase, a "radical empiricism," in which the relation between things assumes as much significance as the things themselves.[1]

The basic elements of Whitehead's philosophy are what he terms *actual occasions* or *entities.* His process philosophy deploys an ontology of affect, conceiving of the emergence of the distinction between subject and object as a second-order effect in a cyclical yet differential ecology of onset and perishing. Moreover, subject and object are not conceived in epistemological terms, with the subject the knower and the object the known thing/world. Rather, the "occasion as subject has a "concern" for the object. And the "concern" at once places the object as a component in the experience of the subject, with an affective tone drawn from this object and directed towards it."[2] Instead, the reformulated subject-object relation "can be conceived as Recipient and Provoker, where the fact provoked is an affective tone about the status of the provoker in the provoked experience."[3]

The becoming of an actual occasion is, for Whitehead, analyzable into modes, whereby the occasion itself is subject and the thing or datum (autonomous from the occasion itself) becomes object as drawn into relation with the specific emergent event. "Thus subject and object are relative terms. An occasion is a subject in respect to its special activity concerning an object and anything is an object in respect to its provocation of some special activity within a subject."[4] This mutual relation of provocation, Whitehead terms *prehension,* and it is marked by three key factors: "There is the occasion of experience within which the prehension is a detail of activity; there is the datum whose relevance provokes the origination of this prehension; this datum is the prehended object; there is the subjective form, which is the affective tone determining the effectiveness of that prehension in that occasion of experience."[5]

Actual entities, prehensions, and nexus are the basic facts of experience for Whitehead. A prehension is a "simple physical feeling," and actual entities that feel one another constitute a nexus. Yet a simple physical feeling also means the feeling of a prehension (the feeling of a feeling) Here, perception of an object is not of a closed entity, but rather the perception of the potential of an object to perceive and be perceived. A nexus is a relational entity, based purely on mutual immanence, where relation is composed of mutual prehension or mutual objectification. An actual occasion is a limit case of an event or nexus, having only one member. The nexus, or collective entity, is an event in its own right, greater than the sum of actual entities and their feelings from which it is composed. Each actual entity is a numerically distinct entity from its component prehensions, and each nexus is numerically distinct from its constituent entities. It is greater than a mere mode of togetherness such as a set or multiplicity, yet it could be

said that it has intermediate reality in the same way that James takes relations between things as facts as much as the things themselves. A nexus is therefore not merely subjective but also objective:

> A nexus enjoys "social order" when i) there is a common element of form illustrated in the definiteness of each of its included actual entities, and ii) this common element of form arises in each member of the nexus by reason of the conditions imposed upon it by its prehensions of some other members of the nexus, and iii) these prehensions impose that condition of reproduction by reason of their inclusion of positive feelings involving that common form. Such a nexus is called a "society," and the common form is the "defining characteristic" of that society.[6]

What is the process of construction of a nexus or "society of actual entities"? First, an actual entity must come into being through the imminent process of concrescence. The cycle of the actual occasion can be analyzed in terms of phases of concrescence. This process involves a multiplicity of simple physical feelings of antecedent actual entities, the derivation of conceptual prehensions, and the integral prehensions leading toward satisfaction, whereby an actual entity becomes "one complex, fully determinate feeling." As the actual entities in a nexus come into being, their intermediate reality, the nexus of the actual entities, comes into being.

1929: Throbs of Experience

18

> To hear this noise as we do, we must hear the parts which make up this whole, that is the noise of each wave, although each of these little noises makes itself known only when combined confusedly with all the others, and would not be noticed if the wave which made it were by itself.
>
> —G. W. Leibniz, *New Essays on Human Understanding* (1981)

It is interesting to note Whitehead's choice of language in *Process and Reality* in paraphrasing William James's notion of the "basic drops of experience" or his own concept of an actual occasion or entity. Whitehead terms an actual occasion or entity a "throb" or "pulse" of experience, a "throb" or "pulse" of feeling, hinting at the role in invention (or creative advance, Whitehead's name for the process of becoming) of the expression of vibration.[1] Whitehead's thoughts on rhythm and vibration form an aesthetic ontology of pulses. To say that Whitehead's ontology is aesthetic means that he posits feeling, or prehension, as a basic condition of experience. For him, even science emerges out of aesthetic experience.[2] His ontology revolves around a nonanthropocentric concept of feeling. This notion of prehension exceeds the phenomenological demarcation of the human body as the center of experience and at the same time adds a new inflection to an understanding of the feelings, sensuous and nonsensuous, concrete and abstract, of such entities. To feel a thing is to be affected by that thing. The mode of affection, or the way the "prehensor" is changed, is the very content of what it feels. Every event in the universe is in this sense an episode of feeling,

even in the void. Whitehead sets up "a hierarchy of categories of feeling," from the "wave-lengths and vibrations" of subatomic physics to the subtleties of human experience.[3] Crucially however, the hierarchy does not imply the dominance of conscious over nonconscious vibrations. At every scale, events are felt and processed as modes of feeling before they are cognized and categorized in schemas of knowledge. It is this complex emphasis on the primacy of prehension that makes his ontology aesthetic.

In his *Enquiry Concerning the Principles of Natural Knowledge* from 1919, Whitehead lays out an early version of his own theory of rhythm. His first rhythmanalytic move is to point out that things that appear static are always composed at the molecular level by vibrating, that is, microrhythmically mobile particles. So he notes, "The physical object, apparent, is a material object and as such is uniform; but when we turn to the causal components of such an object, the apparent character of the whole situation is thereby superseded by the rhythmic quasi-periodic characters of a multitude of parts which are the situations of molecules." In *Adventures,* the seeming simplicity of perception is therefore always shadowed by imperceptible excitation so that "any situation has, as its counterpart in that situation, more complex, subtler rhythms than those whose aggregate is essential for the physical object."[4]

Later, in Lecture 3 from *Religion in the Making,* a series of lectures given in 1926, Whitehead, in outlining this aesthetic ontology, notes how the tension between stable, coherent pattern and the level of imperceptible vibration is the engine of invention in providing necessary "contrast":

> The consequent must agree with the ground in general type so as to preserve definiteness, but it must contrast with it in respect to contrary instances so as to obtain vividness and quality. In the physical world, this principle of contrast under an identity expresses itself in the physical law that vibration enters into the ultimate nature of atomic organisms. Vibration is the recurrence of contrast within identity of type. The whole possibility of measurement in the physical world depends on this principle. To measure is to count vibrations. . . . Thus physical quantities are aggregates of physical vibrations, and physical vibrations are the expression among the abstractions of physical science of the fundamental principle of aesthetic experience.[5]

Unlike Bergson, Whitehead does not indict physics for the method of abstraction, through chopping up the continuity of duration, but instead points to the power of science through this very process of abstraction. Unlike Bergson, Whitehead makes room for the fact that the science of acoustics, of the quantifi-

cation of vibration, rather than merely capturing, has also led to the intensification of sonic affect.

In Whitehead's philosophy, the throb of feeling is not perceived by a subject as such but rather constitutes the actual occasion out of which the distinction between subject and object emerges in a process he terms *concrescence*. Concrescence here can be understood as a rhythmic coalescence that results in the actualization of one block of space-time, among many, simultaneously rendering the division between subject and object, time and space of a second order. Moreover, the need to revise the relation between cause and event is reinforced. Instead of a cause producing an effect, effects attain autonomy in the process of the becoming of continuity. If the primary metaphysical ground is made up, for Bachelard, of instants and, for Bergson, of continuity, then Whitehead has a unique way of reconciling this apparent opposition that he terms the *extensive continuum*. This extensive continuum constitutes a kind of rhythmic anarchitecture that unites the discreet and the continuous, Bachelard's rhythmic arithmetic with Bergson's rippling waves of intensity.

In contrast to a continuity of becoming in Bergson, a spatiotemporality where the unity of events lies in an underlying continual temporal invariant, a flowing lived duration, Whitehead's notion of the extensive continuum undoes the split between space and time. It expresses a general scheme of relatedness between actual entities in the actual world. More than that, Whitehead insists that the extensive continuum is, above all, a potential for actual relatedness. The continuum gives potential, while the actual is atomic or quantic by nature. The continuum is not pregiven but exists only in the spatiotemporal gaps between actual occasions. Rather than an underlying continual invariant, each actual entity produces the continuum for itself from the angle of its own occurrence. Only in this way is the continuum the means by which occasions are united in one common world. The actual entity breaks up its continuum realizing the *eternal object,* or particular potential that it selects. This breaking up, atomization or quantization, forces the eternal object into the space-time of the actual occasion; in other words, as the pure potential of the eternal object ingresses into actuality, it forces the becoming of actuality, and at the same time, pure potential becomes real potential.

Whitehead describes the general potentiality of the continuum as "the bundle of possibilities, mutually consistent or alternative, provided by the multiplicity of eternal objects." The extensive continuum "is that first determination of

order—that is, of real potentiality, arising out of the general character of the world . . . it does not involve shapes, dimensions, or measurability; these are additional determinations of real potentiality arising from our cosmic epoch."[6]

Arguing against both a continual flow of becoming, governed by unspatialized pure time, and the locality of space-time, Whitehead's extensive continuum points to vibratory potentials jelling a multiplicity of space-times: here there is a resonance of actual occasions, which are able to enter into one another by selecting potentials or eternal objects. It is in such a potential coalescence of one region with another that an affective encounter between distinct actual entities occurs. The vibratory resonance between actual occasions in their own regions of space-time occurs through the rhythmic potential of eternal objects, which enables the participation of one entity in another. This rhythmic potential exceeds the actual occasion into which it ingresses. To become, an actual entity must be out of phase with itself, self-contrasting; its tendency is to die and become other.

Whitehead, through the concept of the extensive continuum, makes access possible to the achronological nexus outside the split between space and time. This rhythmic anarchitecture is marked by the becoming of continuity that denotes change. *Anarchitecture* here indicates a method of composition, an activity of construction, which feeds off the vibratory tension between contrasting occasions. In this sense, the continuum is not pregiven but is a process enacted in the resonance of one pulse of experience with another.

For the theory of sonic warfare, Whitehead's conception of the nexus, recoded in terms of rhythm, is very productive. It is rhythm that conjoins the discontinuous entities of matter. This rhythm cannot be reduced to its phenomenological experience. The prehension of a rhythmic anarchitecture is amodal. Rhythm proper cannot be perceived purely through the five senses but is crucially transensory or even nonsensuous. This is especially true of the rhythm of potential relation that holds a nexus together. Irrelevant of scale, physical, physiological, or sonic, a nexus is always collective, polyrhythmic, composed of an array of tensile spaces and durations. Finally, rhythmic mutation would be what Whitehead terms *creative advance* and entails the futurity of a nexus anticipated in its passing present.

1677: Ecology of Speeds

19

It is not just a matter of music but of how to live: it is by speed and slowness that one slips in amongst things, that one connects with something else. One never commences; one never has a tabula rasa; one slips in, enters in the middle; one takes up or lays down rhythms.

—Gilles Deleuze, *Spinoza: Practical Philosophy* (1970)

What is the affective dimension of this rhythmic anarchitecture? Bearing in mind some important qualifications, it can constructively be rerouted through Spinoza's philosophy. If an entity can, in part, be conceived of in terms of its rhythmic composition of speeds and slowness, it also is expressed in terms of its power to affect and be affected.

At the outset of *Process and Reality,* Whitehead allies closely to Spinoza with some important reservations.[1] Spinoza's monist idea that there is one substance (also known as nature or god) with an infinite number of modes is commended by Whitehead for moving away from Descartes' arbitrary dualism that maintained that there were only two irreconcilable substances: mind and body. Yet Whitehead rejects Spinoza's monism because it leaves a new, unbridgeable gap between the one substance and the infinity of modes. So Whitehead subtracts the all-encompassing substance/nature, replacing it with a more Leibnizian notion of a multitude of entities. Instead of the fact of one enveloping substance, Whitehead opts for pure process as the ultimate. This is the means by which these atomistic entities, or actual occasions of experience, are connected.

This divergence has implications for how an entity's change and invention is conceived. For Spinoza, a modification of substance, or mode, has a conatus, which is its tendency to persist beyond its current power. This can be contrasted with Whitehead's notion of creative advance, which insists that instead of its essence being for it to persist in its power, even in an open-ended fashion, the essence of an actual occasion for Whitehead is to become other by reaching satisfaction and then perishing. At the same time, one important convergence between Spinoza and Whitehead is in their nonanthropocentric notion of a body essential for a vibrational ontology. While not identical (the body for Whitehead is not exactly the actual occasion, but rather its associated milieu that contributes its prehensive "data" with the actual occasion as an emergent subjective form), what Spinoza's concept of the body and Whitehead's notion of an actual occasion and its prehensive milieu share is that their humanoid manifestation is really just one instance among many.[2] In both, what is implied here is that the individuated humanoid body is itself made up of a multitude of bodies and the resolution of this numerical problem is merely a matter of scale. As Deleuze argues, for Spinoza, "a body can be anything . . . a body of sounds . . . it can be a linguistic corpus, a social body, a collectivity. The longitudes and latitudes together constitute Nature, the plane of immanence or consistency, which is always variable and is consistently being altered, composed and recomposed, by individuals and collectivities."[3] This expanded definition of a body opens another angle onto the concept of a sonic nexus taken as a collective entity defined by its degree of vibrational consistency.

The first task here would be to analyze the rhythmic composition of a nexus and the way such a nexus of experience retains the past, processes its present, and anticipates its future. A second task of such an approach would be to examine the affective potential of such a rhythmic composition, its power to affect and be affected, and its scope to increase this potential. A third task would relate to the transmutation of the nexus itself, its perishing in the process of invention.

To conceive of this vibrating nexus, it is first necessary to reconfigure its environment as an ecology of speeds. To do this, specific aspects of the philosophy of Spinoza can be turned to, especially as a deviation from Cartesianism, which, having dominated Western thought, now haunts, according to Erik Davis and others, recent conceptions of the virtual.[4] Spinoza replaces Cartesian dualism and its mind-body split with a parallelism in which mind and body are the same substance under different aspects. According to a crucial set of axioms from Spinoza's *Ethics,* "All bodies are either in motion or at rest," and "each single

body can move at varying speeds." Since there is only one substance, which cuts through all thought and extension, we cannot differentiate bodies with reference to substance itself. Rather, Spinoza maintains that "bodies are distinguished from one another in respect of motion and rest, quickness and slowness."[5] As attributes of nature run parallel to one another, only another body can affect a body, and only an idea can affect another idea. Therefore, a body is set in motion, at a specific relation of speed or slowness, only because it was affected to do so by another body in motion. Spinoza argues against the dominion of the mind over the body, hacking the affective grid of the Cartesian head case and thereby inspiring affective neuroscience several hundred years later. Most important, a body *is,* not because it thinks, but because of its power to affect and be affected. And for Spinoza, we do not yet know this power. We do not yet know what a body can do!

Understood through the rhythmanalytic method, the concept of speed at work is very different from Marinetti's cryptofascist celebration that forms the object for Virilio's technological lament in *Speed and Politics.*[6] Crucially, Deleuze and Guattari make a distinction between two senses of speed—on the one hand, as connoting fast movement of an actual body, while on the other relating to the rhythmic consistency of a virtual body. This distinction is fundamental to their unique version of Spinoza's philosophy of nature. As opposed to Virilio's dromology, Deleuze and Guattari's Spinozist conception of cartography is more rhythmanalytic. While many emphasize the vast architecture of Spinoza's geometrical method, their Spinoza is quite unique in its focus on an affective ecology of speeds. For Spinoza, the human, as a mode of nature, has access to only two of the infinite attributes of substance, thought and extension. In his Spinozist definition of a body, Deleuze writes that we need two complementary accounts relating to a body's kinetic and dynamic relations. In a kinetic field, "a body, however small it may be, is composed of an infinite number of particles; it is the relations of motion and rest, of speeds and slownesses between particles, that define a body, the individuality of a body."[7] On the other hand, in a dynamic phase space, bounded by a maximum and minimum threshold, "a body affects other bodies, or is affected by other bodies; it is this capacity for affecting and being affected that also defines a body in its individuality."[8] This rhythmic cartography comprises several crucial and corresponding conceptual distinctions—between longitude and latitude, kinetics and dynamics, movement and speed, the extensive and the intensive. In *A Thousand Plateaus,* Deleuze and Guattari point out that "a movement may be very fast, but that does not give it

speed; a speed may be very slow, or even immobile, yet it is still speed. Movement is extensive; speed is intensive. Movement designates the relative character of a body considered as "one," and which goes from point to point; *speed, on the contrary, constitutes the absolute character of a body whose irreducible parts (atoms) occupy or fill a smooth space in the manner of a vortex, with the possibility of springing up at any point.*"[9]

By arguing that speed is intensive and motion extensive, they are pointing to the difference between an abstract line of speed and point-to-point movement. Movement here is measurable speed. On a Cartesian axis designating space-time, where the vertical y-axis traces distance and the horizontal x-axis time, speed is measured by dividing the distance covered by the time taken. This measured speed, Deleuze and Guattari wish to designate as movement. But speed is a diagonal, whose double articulation splits it into space and time. This diagonal of pure speed coincides with the virtuality of the rhythmic nexus: amodal, sensible only in its effects, under continuous variation, cyclically discontinuous. It should be pointed out here that what differentiates this notion of speed from its apparent Bergsonism is that speed entails a compression of both space and time, not just a pure temporality.

This ecology of speeds implies that bodies, including collective bodies, are defined not as closed, determinate systems, formed, or identifiable merely by their constituent parts or organs and tending toward rhythmic equilibrium or harmony, but rather by their rhythmic consistency and affective potential. What is interesting, from a Spinozist point of view, is not what an entity is, but rather what it can do. In such terms, a body is, for Deleuze and Guattari, defined through its longitude and latitude, where the longitude corresponds to "the sum total of the material elements belonging to it under given relations of movement and rest, speed and slowness."[10] That is to say, the longitude of an entity is the set of relations that compose it out of unformed elements:[11] "the particle aggregates belonging to that body in a given relation [where] these aggregates are part of each other depending on the composition of the relation that defines the individuated assemblage of the body."[12] The latitude of such an entity, on the other hand, corresponds to the "the sum total of the intensive affects it is capable of at a given power or degree of potential."[13] The latitude of an entity is the "set of affects that occupy a body at each moment, that is, the intensive states of an *anonymous force* (force for existing, capacity for being affected)."[14] It constitutes the "affects of which it is capable at a given degree of power, or rather within the limits of

that degree. *Latitude is made up of intensive parts falling under a capacity, and longitude of extensive parts falling under a relation.*"[15]

In these terms, a vibratory nexus falls under two distinct aspects: its composition (rhythmic consistency) and its capacity to affect and be affected by other entities. These conceptual components can be deployed to map the affective mobilization of a population immanent to a rhythmic anarchitecture. If an entity is defined by its vibrational consistency, how does invention occur? To return to the tension between a Spinozan affective ecology of speeds and a Whiteheadian version of rhythmanalysis, it should be remembered that each version suggests a slightly different inflection to construction. Either for Spinoza, we do not know yet what an entity can do (where an entity is defined by its power and that power is open-ended), or for Whitehead an occasion is finite, but once it has satisfied its potential, it perishes and becomes something else. While these divergences clearly evidence two contrasting philosophical frameworks, with contrasting notions of bodies or occasions and their potentials, they also may often pragmatically converge.

99–50 B.C.: Rhythm out of Noise 20

The rhythmic motions of a noise are infinite.
—Luigi Russolo, *The Art of Noises* (1913)

My beats travel like a vortex.
—RZA, "Wu Tang Clan 'Triumph' Wu Tang Forever"

The rhythmanalytic method can be developed further with the assistance of some concepts elaborated by Michel Serres. Interestingly, Serres often relies on images of sonic warfare, especially when describing the resonances of a transdisciplinary concept of noise. In *Genesis,* for example, Serres notes that noise "is both battle and racket. . . . Noise is a weapon that, at times, dispenses with weapons. To take up space, to take the place, that is the whole point . . . and noise occupies space faster than weapons can." Later in the text, he continues, "Everyone knows the most daring soldiers go no faster than the music. The noise, first . . . fury belongs . . . above all to the multitude, and the multitude rushes around, it covers space like a flood."[1] Serres's concept of noise, often stands in for, or is interchangeable with, the notion of turbulence from physics.[2] This preoccupation with the emergence of rhythm out of noise derives in part from his interest in the ancient atomic physics of Democritus and Lucretius,[3] particularly in their concept of the angular momentum of nature, the source of its power of invention. This Lucretius-Serres conceptual axis rotates around the concept of the clinamen, or the swerve. In his *On the Nature of the Universe,* Lucretius

helps invent a conception of deviant matter in contrast to its inert caricatures in philosophical hylomorphism. He sets out to map the cosmos without introducing any conception of purpose, final cause, or injecting it with an essence. He outlines the importance of what he calls the *clinamen* as not merely a deviation from order but rather a primary physical process,—for example, "When the atoms are travelling straight down through empty space by their own weight, at quite indeterminate times and places they swerve ever so little from their course, just so much that you can call it a change in direction. If it were not for this swerve, everything would fall downwards like rain-drops through the abyss of space. No collision would take place and no impact of atom on atom would be created. Thus nature would never have created anything."[4]

In this famous statement, the emphasis Lucretius places on change over stability, identity, or constancy indicates an attempt to instate deviation, the clinamen, as primary; the description of the minimum angle of deviation from a straight line, or the onset of a curve from a tangent seems to need inversion. Instead of an accident that befalls predictable or metric matter, the clinamen, as Deleuze clarifies, for the atomists, is the "original determination of the direction of the movement of the atom. It is a kind of conatus—a differential of matter, and by the same token, a differential of thought."[5] So this physics is no longer one of straight lines, parallel channels, or laminarization, but rather the formation of vortices and spirals built out of the swerve.

So perhaps what Michel Serres, through Lucretius, adds to rhythmanalysis is literally a kind of vorticist twist, which counters Bachelard's tendency toward rhythmic equilibrium. When Serres states in *Hermes* that the "physics of the vortex is revolutionary,"[6] he means not in some ideological sense but at the level of material. It is not simply that a vortex makes matter turn, but rather matter itself curves. If it did not, it would be confined to straight lines, without even zigzags, and the universe would never invent anything new. As he remarks, the "minimal angle of turbulence produces the first spirals here and there. It is literally revolution. Or it is the first evolution toward something else other than the same. . . . The first vortices . . . pockets of turbulence scattered in flowing fluid, be it air or salt water, breaking up the parallelism of its repetitive waves."[7]

Serres's analysis of the birth of physics is built into Deleuze and Guattari's transversal conception of a war machine.[8] It is interesting, therefore, in the context of this discussion, to speculatively extend Deleuze and Guattari's notion of the war machine into the sonic.[9] Such a war machine described in *A Thousand Plateaus* takes as its abstract model a theory of fluids, the rhythmic consistency

of liquids as opposed to solids. Their theory of the war machine parallels the dynamical aspects of their own variant of rhythmanalysis, developed in relation to their concept of the "refrain." They deploy a hydraulic model of the war machine that "consists in a population being distributed by turbulence across a smooth space, in producing a movement that holds space and simultaneously affects all of its points, instead of being held by space in a local movement from one specified point to another." In such a system, as Deleuze and Guattari continue, "one no longer goes from the straight line to its parallels, in a lamellar or laminar flow, but from a curvilinear declination to the formation of spirals and vortices on an inclined plane: the greatest slope for the smallest angle."[10]

In summary, the vortex is the model of the generation of rhythm out of noise. It is a power of creation and destruction: it simultaneously blocks flow while accelerating it, and it is this ambivalence that makes Deleuze and Guattari turn to it as the abstract model of the war machine, confounding the more benign interpretations of their work, which focus purely on flow. The Lucretius-Serres-Deleuze and Guattari axis and its dependence on the clinamen as engine of angular momentum gives a vorticist spin to rhythmanalysis. Asymmetry and imbalance are taken as the reservoir of invention in contrast to the stability, harmony, and equilibrium implied by Bachelard and Lefebvre. For instance, whereas Bachelard's version of the rhythmanalytic method seemed most interested in the orchestration of counterrhythms into equilibrium states, abstract vorticism occupies itself more with the intensification of turbulence. This virulent strand of rhythmanalysis finds polyrhythms curving off in every direction, forming a rhythmic anarchitecture, the ontological ground for any micropolitics of frequency. Yet this ground does not dictate the orientation of such a micropolitics; it does not lay down a set of generalizable laws but rather throws up a series of engineering problems. As such, any micropolitics derivable from this base can be only tactical rather than strategic—a war without aims concerned more with disposition and potential movement than ideology, although certainly susceptible to abduction. This understanding of noise as rhythmic reservoir is perhaps only latent in Attali's political theory of noise, but it is certainly the one of most interest here.

1992: The Throbbing Crowd 21

The regime of the war machine is . . . that of affects, which relate to the moving body in itself, to speeds and compositions of speed among elements. . . . Affects are projectiles like weapons.

—Gilles Deleuze and Felix Guattari, *A Thousand Plateaus* (1988)

In a release from a U.S. Army Research Laboratory in 2001,[1] two volatile crowd situations were considered:

> One was a small group of people positioned at knife throwing distances, such as in a civilian prison riot. . . . The other situation . . . was a large rioting crowd threatening troops at a stone-throwing distance . . . based on first hand experiences with large riots in the Middle East, which left a sense of "thermoclines"[2] in the crowd; i.e. the first few rows of people were "hot" and "dangerous," and the back rows were "cooler" adventurers, who only became dangerous if mishandled.

The "nonlethal" sonic weapon under study was the "vortex ring generator," designed to "target individual[s with] a series of flash, impact, and concussion pulses at frequencies near the resonance of human body parts,"[3] forcing evacuation from the zone of disturbance, fighting social turbulence with air turbulence. Such tactical instances of sonic warfare draw attention to the directions in which control of volatile social groups, "far from equilibrium," is developing through the investigation of volatile properties of material systems "far from equilibrium." Such cases serve as a portal into the problem of turbulence and its controlled propagation through the management and intervention into the

rhythmicity of urban systems,[4] the modulation of the ecology of fear and its affective potential to spiral out of control. It is in the context of these basic population dynamics that sonic warfare should be understood, intervening into the affective ecology of crowds.

A precursor to this discussion can be found in Elias Canetti's physics of populations in *Crowds and Power.* Canetti argues that the affect of fear, particularly of being touched by the unknown, forms a basic logic of population physics. It serves as an intangible force keeping individuals apart. Yet with crowd formations, this principle is reversed, and the density of bodies helps overcome the repulsive power of fear into an attractive power. This threshold of reversal results is what Canetti calls the discharge, leading to the formation of the crowd and the eradication of differences.

Packs form a more basic type of entity out of which crowds are composed. Canetti notes four kinds of pack: the hunting pack, the war pack, the lamenting pack, and the increase pack. Packs are marked by their mobility, unlike crowds, which tend to be more static. Crowds are particularly the product of the city, he argues, irrigating packs through the urban channels of streets and squares, forcing them to resonate, accumulate, and grow, with the affective geometry and architecture of the built environment activating both negative and positive feedback processes. A movement of growth can continue or be impeded, resulting in what he calls the open or closed crowds. This is a volatile dynamic and can lead to eruptions if there is a sudden transition from a closed to an open crowd—or a sudden disintegration can be a symptom of pure panic. To fend off this disintegration, the crowd needs a goal. The temporality of the goal determines whether the crowd is fast or slow in its dissipation. As an entity in formation, what crowds seem to desire is density. As density increases, the units that make up the crowd are decomposed and recomposed, with subcomponents of these units flattened out and affectively networked with the subcomponents of other units—limb by limb by limb. Canetti calls this "equality," where a part object becomes disorganized and circuited with other part objects. The manner in which density and equality develop forces the crowd to stagnate or vibrate rhythmically.[5]

Like Whitehead's nexus, composed of throbs of experience, Canetti's morphology and his notion of the "throbbing," rhythmic crowd sketches a population on the social scale that resonates with the more abstract descriptions of the vorticist rhythmanalysis of vibration. The key dimension of any gathering of bodies, from the point of view of control or becoming, is those critical thresh-

olds across which the transitory body of the crowd concresces, individuates, perishes, and enters into new modes of composition. He describes a topology of vibrating collective entities, contorted intensively by their affective temperature, and channeled extensively through the irrigation of street systems and the built environment. Such a critical threshold, for example, may mark the onset of violence, the onset of dance, or other collective rhythmic convulsions as unactualized potentials become kinesthetic spasms. A theory of sonic warfare is particularly fascinated by this turbulent boundary layer between dance and violence.

This analysis is developed still further by Philip Turetsky, who reads the analysis of the throbbing crowd via Deleuze's *Difference and Repetition,* unfolding the rhythmic syntheses of past, present, and future that such collectives undertake in the formation of a vibratory entity.[6] In the case of the throbbing crowd, its vibratory nexus both dis- and reorganizes body parts and individuates them into an event with its own duration. Rhythm, for Turetsky, is both a set of relations between formed matters and an expression of a "distribution of accents marking off an abstract organisation of temporal intervals. . . . This rhythmic organisation combines, that is, synthesizes, the formed matters into a single body, the groups of abstract intervals into a single event, in a single assemblage in which the two become articulated together."[7] Rhythm therefore organizes heterogeneous materials in two ways. It distributes in time and simultaneously emerges out of the very differences between elements. Rhythm is abstract in the sense that it is platform independent. A composition of materials can result in almost any rhythm. In addition to the kinetic modulation of populations in motion, rhythm transforms the affective potential of the individuated entity, producing new connections between part objects, intensifying collective excitation and mood, transforming the crowd into an attractional or repulsive force in relation to outsiders. The diagram of such rhythmic populations can be termed, extending a concept of Kodwo Eshun, a *rhythmachine.* A rhythmachine is a synthesizer that processes a chaotic datum in its self-generation, connecting, for Turetsky, following Deleuze, successive moments into a passing present, some of which constitute the past of this present and others that generally anticipate its future. In terms of invention, the essential part of this process of synthesis, however, faces futurity in order to break with memory, habit, and the repetition of the same. The parallels with Whitehead's description of the process of concrescence and creative advance are apparent here. Yet the confinement of a rhythmic nexus to a purely temporal phenomenon, while a common inheritance from musicology, is exactly the move that rhythmanalysis seeks to move

beyond. Rhythm in fact should be understood differently, as spatial as it is temporal. Rather like Whitehead's extensive continuum and Deleuze and Guattari's concept of the *refrain,* space and time decompress out of a rhythmic anarchitecture. The vortical entities of the rhythmic crowd produce and destroy their own pocket of space-time. The militarized deployment of acoustic weapons therefore, as well as a sonic intervention into a turbulent zone of disturbance, is also a dynamic one: the insertion of a rhythmic component as provocation or affective projectile.

1993: Vorticist Rhythmachines 22

Water carried the sound of the drums and sound carried the distance between the old and the new world.

—Black Audio Film Collective, *The Last Angel of History* (1997)

The rhythmic vorticism that runs through Serres to Deleuze and Guattari takes as its model the rhythmicity of hydrodynamics, particularly the interruption of predictable flow by the emergence of pockets of turbulence. Another strand of this orientation can be found in *Cinema 1,* where Deleuze writes, "Water is the most perfect environment in which movement can be extracted from the thing moved, or mobility from the movement itself. This is the origin of the visual and auditory importance of water in research on rhythm."[1] Hints of this rhythmic hydrodynamics also crop up elsewhere. For example, the parallel between early acoustics and fluid mechanics can be found in Hermann Helmholtz, whose late–nineteenth-century text, *On the Sensation of Tone,* became canonical in the science of acoustics. Helmholtz began his research treating acoustics as a branch of hydrodynamics.

The generation of a vibrational nexus is paralleled by the decompression of rhythm from noise. The question of turbulence, the volatile tension between order and chaos, is shunted into a question of vibration as microrhythm. According to the branch of engineering concerned with sonic vortices, all sonic phenomena, as particle and wave kinetics, can, at least in their physical dimension, be conceived of as problems of fluid or aerodynamic turbulence. In

physics, *vortex sound* is sound generated as a by-product of unsteady fluid motions. As Howe has pointed out, "It is now widely recognized that *any* mechanism that produces sound can actually be formulated as a problem of aerodynamic sound":[2]

> Thus apart from the high speed turbulent jet—which may be regarded as a distribution of intense velocity fluctuations that generate sound by converting a tiny fraction of the jet *rotational* kinetic energy into the longitudinal waves that constitute sound—colliding solid bodies, aero engine rotor blades, vibrating surfaces, complex fluid-structure interactions in the larynx (responsible for speech), musical instruments, conventional loudspeakers, crackling paper, explosions, combustion and combustion instabilities in rockets, and so forth all fall within the theory of aerodynamic sound in its broadest sense. . . . Any fluid that possesses intrinsic kinetic energy, that is, energy not directly attributable to a moving boundary . . . must possess *vorticity*. . . . In a certain sense and for a vast number of flows, vorticity may be regarded as the ultimate source of the sound generated by the flow.[3]

This idea of vortex sound has key resonances in different registers, from the vibrational patternings of cymatics through to the hyperrhythmic dynamics of electronic music. In his key late 1990s essays reframing the concept of "acoustic cyberspace," Erik Davis described how contemporary conceptions of virtual reality were trapped in a visual model of space inherited in particular from Descartes' split between the mind and the body, whereby the self transcends space, is detached from it, surveys it panoptically, as a disembodied vision machine (where "I" is synonymous with "eye"). For Davis, the legacy of this model (traces of which can be found in Gibson's 1980s descriptions of cyberspace) had dominated the proliferating discourses on the digital since then. Instead, Davis, in parallel to Kodwo Eshun's analysis in *More Brilliant Than the Sun,* drew from the polyrhythmic nexus and bass viscosity of Black Atlantian musics, alongside McLuhan's conception of acoustic space, in order to develop an alternative version of virtual space, one that is sonic but, more than that, is essentially invasive, resonant, vibratory, and immersive. In this vibrational ecology, the sensual mathematics of a rhythmachine possesses the affective sensorium, inserting itself amodally (between the senses), generating a polyrhythmic nexus.[4]

There is an interesting contrast between futurism's celebration of the art of war in the noise and Afrofuturism's art of war in the art of rhythm. In *The Art of Noises*, Russolo bemoans rhythm, complaining that "the first beat brings to your ear the weariness of something heard before and makes you anticipate the boredom of the beat that follows. So let us drink in, from beat to beat, these few

qualities of obvious tedium, always waiting for that extraordinary sensation that never comes."[5]

While the concept of noise forges, for futurism, in its nexus of war machines and sound machines a sonic militancy, Afrofuturist musics such as jungle, Davis argued, drawing from Deleuze and Guattari, congealed around rhythmic turbulence. It should be remembered, however, that the philosophers draw from a European avant-classical tradition of music and sonic experimentation that was in fact antagonistic toward and sacrificed rhythmic speed for a "nonpulsed time," a cerebral listening, or mental dance that they would refer to as "voyaging in place." In their discussion of the refrain, Deleuze and Guattari set out to salvage the concept of "rhythm" from being merely understood as synonymous with "form," a form that measures and regularizes the pace of movement, as opposed to a topological form that arises from immanent material processes. They admit that there "is indeed such a thing as measure, cadenced rhythm, relating to the coursing of a river between its banks or to the form of a striated space; but there is also a rhythm without measure, which relates to the up swell of a flow, in other words, to the manner in which a fluid occupies a smooth space."[6]

In this distinction between meter and rhythm, they draw explicitly from Messiaen's controversial comments regarding the history of African American music, eliding a set of problems and thereby limiting the potential of their wider rhythmanalytic innovations. Discussing, on the one hand, jazz, and, on the other, military music as the generation of rhythm, Messaien argues:

> Jazz is established against a background of equal note-values. By the play of syncopation it also contains rhythms, but these syncopations only exist because they're placed on equal note-values, which they contradict. Despite the rhythm produced by this contradiction, the listener once again settles down to equal note-values which give him great comfort. . . . Here's another very striking example of non-rhythmic music which is thought rhythmic: the military march. The march, with its cadential gait and uninterrupted succession of absolutely equal note values, is anti-natural. True marching is accompanied by an extremely irregular swaying; it's a series of falls, more or less avoided, placed at different intervals.[7]

But perhaps Messaien is a little too quick to step over syncopation in his discussions on rhythm. In not uncommon fashion among the European musicological elite that includes Adorno, Messaien treats syncopation, the emphasis on the offbeat, as merely the negative of meter, its shadow, one that is purely derivative. Moreover, and directly concurring with Messaien, Deleuze and Guattari repeat, "There is nothing less rhythmic than the military march."[8]

Such an approach, Chernoff argues in his book *African Rhythm, African Sensibility,* is typical of the profound European misunderstanding of Afro-diasporic rhythmic pragmatics. Chernoff, on the other hand, emphasizes the very in-betweeness of syncopation, which in the rhythmic culture of the African diaspora must be given a more positive spin.[9] As Erik Davis has noted, drawing from Chernoff, in Black Atlantian polyrhythm, "The game is to push the beats to the edge of bifurcation without allowing them to settle into a singular basin of attraction."[10] When the rhythmic movement of the body is taken into account, the military march is time and again thrown up as the epitome of the tempo of war, a disciplined, repetitive, mechanical collective body. For Deleuze and Guattari, in their rhythmanalysis of capture, a state military organization is conceived as a metric crowd, while a nomad war machine is a rhythmic pack. Yet the musical sources they draw from make it deeply problematic to conceive the shape of such a collective mobilization. It is as if the vorticist rhythmachines suggested in *A Thousand Plateaus,* for Eshun and Davis, actually had their stronger analog in Black Atlantian currents of polyrhythmic, electronic music. Both of these interpretations of Deleuze and Guattari's sonic concepts were taken up within the thoughtware of electronic music culture. We also find in much of the modernist avant-garde, right through to contemporary "glitch"-based music and its celebration of "noise" via "accidents" and "chaos," a suppression of rhythm, and therefore of the dancing body, its affective mobilization and rhythmic contagion.[11] This suppression contrasts sharply with the rhythmic "conceptechnics" that emerge from the various dance cultures, which, as Erik Davis puts it, "drum up acoustic cyberspace" through what Kodwo Eshun describes as Black Atlantian rhythmic futurism,[12] what Simon Reynolds has tagged the "hardcore continuum"[13] and what others have referred to more recently as "global ghettotech."[14]

From futurism to Afrofuturism, the avant-gardist sonic war machine that takes the violence of noise as its object transforms into a rhythmachine concerned with beat frequencies "far from equilibrium." If a noise tactics is common to both, then it is only in mutated form. For a rhythmachine, noise shifts from end in itself to a field of pulsive potential. Afrofuturism forces a new set of questions on the futurist legacy of the concept of noise. What potential rhythmachines lurk virtually within its vibrational field? What difference does digitalization force onto this rhythmic potential, where molecular vibration becomes numerical rhythmic quanta?

1946: Virtual Vibrations

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While cymatics vividly illustrates the rhythmic field of vibrational, analog wave phenomena, postquantum experimentation with sound and computation has drawn attention to an atomistic digital ontology, whose analysis cannot be subsumed to a topology based on analog waves. This methodological problem, central to the ontology of vibrational force, also lies at the heart of contemporary debates regarding digital sound aesthetics and the textural innovations of granular synthesis. Texture marks the membrane between vibration and skin, and therefore the front line in any deployment of sonic force.

In a provocative essay, "The Superiority of the Analog," Brian Massumi attempts to strip away some of the hype of the digital, arguing that the analog is *always one fold ahead*.[1] Massumi reminds us that there is actually no such thing as digital sound, whether generated on or off a computer; if it is audible, it must be analog. Digital code is audible only after it is transduced into sound waves. With theorists such as Pierre Levy,[2] Massumi wants to cleave apart the erroneous equation of the digital with the virtual. Instead the virtual is defined as potential, while the digital can only tend toward an already coded, and therefore predetermined, range of possibility. As an antidote to the many digital philosophies of computer age hype, the "superiority of the analog" position questions temporal ontologies that emphasize the discreetness of matter through a spatialization of time (in the composition of the digital) in favor of a refocus on the continuity of duration. Typical objections to the ontology of digital temporality share much with the philosophy of Henri Bergson. In Bergson's philosophy of

duration, he argues that the spatialization of time belies the "fundamental illusion" underpinning Western scientific thought. Bergson accordingly criticized this cinematographic error,[3] which he described as cutting continuous time into a series of discreet frames, separated from the temporal elaboration of movement that is added afterward (through the action, in film, of the projector) in terms of the perceptual effect of the persistence of vision. Yet sonic time plays an understated role in Bergson's (imagistic) philosophy of time, often being taken as emblematic of his concept of duration as opposed to the cinematographic illusion of consciousness. In stark contrast to Bachelard, in *Time and Free Will,* Bergson uses the liquidity of the sonic, "the notes of a tune, melting, so to speak, into one another," as exemplifying that aspect of duration he terms interpenetration.[4]

The argument for the "superiority of the analog," in its Bergsonian allegiance to continuity, could easily be taken as an ill-conceived, antidigital phenomenology. But such an interpretation would be misleading. The drive of Massumi's argument is in fact to push for a rigorous theorization of the enfolded nexus, or plexus, of the analog and digital. The question here is what kind of sonic plexus they can compose and where the potential for invention lies in both its analog and digital dimensions.

In his recent book, *Sound Ideas: Music, Machines and Experience,* Aden Evans, without specifically deploying a concept of the virtual, attempts to locate zones of mutational potential within the codes of digital music. Evans describes how digital code stratifies the analog in a double articulation. He raises the question of whether a digital singularity can be conceived, or whether such a singularity would in fact be merely a residue of the process of the digitalization of the analog. The digital stratification of the analog cuts it into parts and then assigns values to these parts. As Evans points out, this articulation is crucially double:

> On the one hand, the bits are spread out linearly, each divided from each, while on the other hand, each bit is either a 0 or 1. Binary numbers have a first articulation (the nth place) and a second articulation (0 or 1 in each place). . . . The binary is nothing but articulation, a simple difference between 0 and 1 . . . [but to] be effective the digital requires another articulation. . . . In the case of sound digitalization, a sound is divided into small chunks of time (samples), and each sample is evaluated by measuring the air pressure at that point in time. . . . A first articulation of parts and a second of values.[5]

However, in this process, Evans argues, using the term *actual* where Massumi would use the *analog,* digitalization "captures the general, the representable, the repeatable, but leaves out the singular, the unique, the immediate: whatever is

not formal. Actuality always exceeds its form, for it moves along lines that connect singularities; the actual is not a neat sequence of frozen or static moments but an irreducible complex process that cannot be cleanly articulated in time or space."[6]

The rules of operation of the digital are immanent to its formal, binary code from which it is composed. Yet the emptiness of this code is what produces its infinite replicability: the clone is always formal, and therefore there is no haeccity as the format is essentially generic, every analog place becoming a numerical space, and every type of analog object tagged by numerical values. So the limits of the digital—"Refinement, precision, storage, isolation"[7]—are exactly its power, that is, its ordering quality, for measuring and counting. The digital is simultaneously exact and reductive. But Evans distinguishes between this exactness and precision. He terms the exactness of digital calculability imprecise in that "it measures its object to a given level of accuracy and no further . . . it presents its own completeness."[8] For Evans, something is lost in this transition from the fullness of the analog to the exact partiality of the digital. There is a residue of the process of stratification, whereby the digital cuts into the analog, and through which continuity is transposed into generic parts, or bytes. This residue is the excluded middle of this process of double articulation. "The digital has a resolution, and detail finer than this resolution is ignored by the digital's ordered thresholds."[9] The analog, on the other hand, for Evans, as a variable continuum, is fuzzy, and responsive—any operation performed on it transforms it. The digital zooms in on the thresholds of the analog, marking variable ranges in this qualitative continuum, quantizing them into a discreteness and exactitude. Paralleling Massumi's thesis that the "analog is always a fold ahead"[10] of the digital, Evans notes that the "superiority" of the analog stems not from a limitation of the digital substitution, its difference from an actual object, but crucially—and this is the crux of their differential ontology—it is "rather a productive difference, a not-yet-determined, an ontological fuzziness inherent to actuality itself. Difference as productive cannot be digitalized."[11] The processual nature of the actual, and its generation of singularity, must exceed its capture. In other words, the actual for Evans exceeds the sum of its digitized parts. This is not merely a phenomenological point. Elsewhere, Evans develops a parallel argument using intuitionist mathematics in relation to the concept of the differential (specifically the *surd*)[12] from calculus and what Deleuze termed the process of *differentiation*. The differential "was an extra term, left over after the rest of the equation had been reduced, and the methods for dealing with it could

not be decided in advance."[13] Evans finds the surd at work in the uncertainty principle of acoustics, concluding that the "digital encounters events or objects that it cannot accommodate, and it must reshape itself in order to make room for these new ideas, but eventually settles back into a placid or rigid formula, neutralizing the novelty that challenged it to develop."[14]

Where Evans's position deviates from Massumi's is in the terminology of the virtual, with Evans locating the productive force in the actual itself, whereas for Massumi, the potential for change lies in fact in the virtual. What Evans calls the actual as opposed to the digital, Massumi terms the analog, composed of the actual and the virtual. Massumi questions the potential of the digital generation of results that are not already precoded. If the digital is to provide access to the virtual, then it would have to "produce unforeseen results using feedback mechanisms to create resonance and interference between routines." A virtual digitality would have to integrate the analog "into itself (bio-muscular robots and the like), by translating itself into the analog (neural nets and other evolutionary systems), or again by multiplying and intensifying its relays into and out of the analog (ubiquitous computing)."[15]

While a healthy skepticism regarding the claims of digital hype is recommended, a rhythmanalysis of the digitalization of sonic matter reveals much about computational mutations in the operative logics of vibrational force. The narrowband of humanoid audio perception is a fold on the discontinuum of vibration. On this field, the musical distinction between rhythm (infrasonic frequencies) and pitch (audible frequencies) dissolves, each merely constituting bands on the frequency spectrum.[16] This vibrational discontinuum can be mapped as *molecular texturhythm*. Referred to as the "great base" by Ezra Pound[17] and explored continuously throughout the twentieth century in the vibrational science of electronic music, the rhythmic ontology of matter flattens the elaborate elevations and stratifications of modern tonality (pitch as a system of frequencies unfolds into a matter of rhythm) into a simultaneously abstract yet felt plane. This plane is populated by molecular entities composed of variations of speed and slowness and marked by fluctuating degrees of affective potential. In the language of Varese or, later, granular synthesis, these bodies can be clouds, vortices, or densifications of sonic matter. This is the plane of microsonic turbulence explored by contemporary digital sound design.

In some suggestive ways, the sonic atomism of granular synthesis converges with the atomism of Whitehead's vibrational anarchitecture. No longer should sonic matter be conceived purely in terms of waveforms, but now also in terms

of grains of sound. The parallel faces of wave and particle open up a rhythmanalysis of microsound. As Sherburne has noted, "Rhythm is texture writ large, peaks and valleys turned to pulse. Texture is rhythm rendered microscopic, (ir) regularity encoded and impressed upon the surface of sound. Where these two break and cleave apart, the click, smooth-faced, one dimensional, textureless and out-of-time."[18]

Perhaps, contra the "superiority of the analog" thesis, the digital encoding of sound at the micro-timescale has opened untold sonic potentials in terms of textural invention, a surplus value over analog processing. A fundamental temporal potential of sonic virtuality is locatable in the very un-Bergsonian realm of digital sampling, known as discrete time sampling.[19] As the Nyquist-Shannon theorem explained, "A continuous band-limited signal can be replaced by a discrete sequence of samples without loss of any information and describes how the original continuous signal can be reconstructed from the samples."[20] At a fundamental level, in its slicing of sonic matter into a multiplicity of freeze frames, digital samples treat analog continuity as bytes of numerically coded sonic time and intensity, grains that may or may not assume the consistency of tone fusion, the sonic equivalent of the persistence of vision.

In contrast to the Bergsonian emphasis on continuity in duration, in the 1940s, the elementary granularity of sonic matter was noted by physicist Dennis Gabor, dividing time and frequency according to a grid known as the Gabor matrix. Prising open this quantum dimension of sonic time opened the field of potential that much more recently became the time-stretching tool within digital sound editing applications.[21] The technique "elongates sounds without altering their pitch, [and] demonstrates how the speed at which levels of acoustic intensity are digitally recorded (44,000 samples/second at standard CD quality) means that a certain level of destratification is automatically accomplished. Since magnitudes (of acoustic intensity) are all that each sample bit contains, they can be manipulated so as to operate underneath the stratification of pitch and duration, which depends on the differentiation of the relatively slow comprehensive temporality of cycles per second."[22]

The technique referred to as time stretching cuts the continuity between the duration of a sonic event and its frequency. In granular synthesis, discreet digital particles of time are modulated and sonic matter synthesized at the quantum level. In analog processing, to lower the pitch of a sound event adds to the length of the event. Slow down a record on a turntable, for example, and a given word not only descends in pitch but takes a longer time to unfold. Or allocate a

discreet sampled sound object to a zone of a MIDI keyboard; the difference between triggering the sample using one key and moving to a key one octave down doubles the time of the sound and halves its pitch. Time stretching, however, facilitates the manipulation of the length of a sonic event while maintaining its pitch, and vice versa. Time stretching as a digital manipulation process has become increasingly common to electronic music software, particularly in the transposing of project elements between one tempo and another, fine-tuning instruments, but also as a textural effect producing temporal perturbations in anomalous durations and cerated consistencies.

These texturhythmic innovations add new complexions to the ontology of vibrational force, new ways in which sound impresses on the skin, touches, affects, and infects. While the digital, it is argued, in its discrete binary constitution of bytes frames a predetermined, precoded field of demarcated possibility, can there not be a potential for mutation immanent to the numerical code itself? Digital philosophers such as Gregory Chaitin hint at this when they map the contagion of the uncalculable, irreducible real, which always exceeds axiomatization.[23] A too quick dismissal of the digital, articulated without an exploration of the numerical dimensions of the virtual at work in mathematical problematics and in popular numeracy, risks falling back into a phenomenological fetishization of the emergent plenitude of the analog. What is required is an affective calculus of quantum rhythm. Such a calculus would map the rhythmic oscillations that vibrate the microsonic, and the molecular turbulence these generate, a spiral that scales up through the nexus of the analog and digital (a sonic plexus)—its codes and networks of affective contagion. *Sonic warfare* becomes a sensual mathematics.

2012: Artificial Acoustic Agencies 24

There are these other forms of life, artificial ones, that want to come into existence. And they are using me as a vehicle for its reproduction and its implementation.

—Chris Langton, *Artificial Life: An Overview* (1997)

At an elementary scale of the sensual mathematics of sonic warfare, digi-sonic matter is marked by the granular texture of microsampled sound. Another question of sonic digitality and power, operating on the higher level of morphological mutation, is occupied with evolutionary algorithms and cellular automata. Computers have upgraded both what it means to be a musician and a military strategist.[1] Yet the celebration of "decontrol" (setting up rule-based systems and letting them do all the work) and the simulation and modeling advantages these offer have a flip side. Picture, for a moment, a convergence between preemptive capital future-casting the desires of consumers, the acoustic intimacy of either directional audio spotlights or iPods, personalized targeting by retinal scans or implanted chips and adaptive Muzak systems running generative, randomizable algorithms. Here the experience of the shopping mall takes on a particularly predatory disposition. Artificial acoustic agencies or audio viruses would track your movements, continuously modulating your behavior with suggestions, mood enhancements, memory triggers, and reassurances. To be effective, the algorithms of these adaptive systems would have to traverse code, hardware, and the wetware of the body, the digital and the analog. But how would this mode of sensual mathematics work?

As well as new textures that enhance sound's sensual contagiousness, digitization has, through generative music software based on cellular automata and genetic algorithms applied to music, injected vibrations with a contagious mathematical dimension, giving them an agency all of their own to evolve, mutate, and spread. These sonic algorithms, or artificial acoustic agencies, are abstract machines—sets of rules that have become independent of their specific physical embodiments, thereby intensifying their powers of transmission, replication, and proliferation. Key musical processes are distilled to formalized equations that are generalizable and transferable. Algorithmic or generative music, whether analog or digital, claims to develop bottom-up approaches to composition. As Nyman points out, they understand systemically the context of composition and production and are "concerned with actions dependent on unpredictable conditions and on variables which arise from within the musical continuity."[2] Examples from the history of experimental music can be found in the oft-cited investigations of rule-centered sonic composition processes in the exploration of randomness and chance. Think, for example, of Cage's use of the I Ching, Terry Riley's "In C," Steve Reich's "It's Gonna Rain" and "Come Out," Cornelius Cardew's "The Great Learning," Christian Wolff's "Burdocks," Frederic Rzewski's "Spacecraft," and Alvin Lucier's "Vespers."[3]

More recent approaches centering on the digital domain make use of software programs such as Supercollider, MaxMsp, Pure Data, Reactor, Camus, Vox Populi, and Harmony Seeker. In addition to the sonic simulations drawn from chaos physics, recent generative sound design projects also draw from evolutionary biology, in particular, artificial life research. These deploy mathematical algorithms to simulate the conditions and dynamics of growth, complexity, emergence, and mutation, and they apply evolution to musical parameters. Placing these experiments in digital sound design in the historical context of earlier experiments with, for example, out-of-phase tape recorders, it becomes clear, Eshun argues, that tape loops already constituted "social software organized to maximise the emergence of unanticipated musical matter." He continues that the "ideas of additive synthesis, loop structure, iteration and duplication are pre-digital. Far from new, the loop as sonic process predates the computer by decades. Synthesis precedes digitality by centuries."[4] While generative music predates the digital, once on computers, these sonic agencies assume some of the powers of computer viruses to evolve, mutate, and spread. How do these virulent algorithmic forms function?

According to Miranda, software models for evolutionary sound generation tend to be based on engines constructed around cellular automata or genetic algorithms.[5] Instead of messy biochemical labs deployed to probe the makeup of chemicals, cells, and so forth, these sonic evolutions take place in the artificial worlds of the CPU, hard disk, computer screen, and speakers. Specifically, the scientific paradigm of artificial life marks a shift from a preoccupation with the composition of matter to the systemic interactions between components out of which nature is under constant construction. Alife uses computers to simulate the functions of these interactions as patterns of information, investigating the global behaviors that arise from a multitude of local conjunctions and interactions. In addition to cellular automata and genetic algorithms, other Alife techniques for analyzing emergent complexity include adaptive games and neural networks. The application of biological patterns of information has been taken up within robotics, the social sciences, humanities, and, most pertinent here, musicology.[6]

The analysis of digital algorithms within the cultural domain of music is not limited to composition and creation. Recent Darwinian evolutionary musicology has attempted to simulate the conditions for the emergence and evolution of music styles as shifting ecologies of rules or conventions for music making. These ecologies, it is claimed, while sustaining their organization, are also subject to change and constant adaptation to the dynamic cultural environment. The suggestion in such studies is that the simulation of complexity usually found within biological systems may illuminate some of the more cryptic dynamics of musical systems.[7] Here, music is understood as an adaptive system of sounds made use of by distributed agents (the members of some kind of collective; in this type of model, typically none of the agents would have access to the others' knowledge except what they hear) engaged in a sonic group encounter, whether as producers or listeners. Such a system would have no global supervision. Typical applications within this musicological context attempt to map the conditions of emergence for the origin and evolution of music cultures modeled as "artificially created worlds inhabited by virtual communities of musicians and listeners. Origins and evolution are studied here in the context of the cultural conventions that may emerge under a number of constraints, for example, psychological, physiological and ecological."[8] Miranda, despite issuing a cautionary note on the limitations of using biological models for the study of cultural phenomena, suggests that the results of such simulations may be of interest

to composers keen to unearth new creation techniques, and asserts that Alife should join acoustics, psychoacoustics, and artificial intelligence in the armory of the scientifically upgraded musician.[9]

The two most common tools used by these technically enhanced musicians are cellular automata and genetic algorithms. Cellular automata were invented in the 1960s by John von Neumann and Stan Ulan as simulations of biological self-reproduction. Such models attempted to explain how an abstract machine could construct a copy of itself automatically. Cellular automata are commonly implemented as an ordered array or grid of variables termed cells. Each component cell of this matrix can be assigned values from a limited set of integers, and each value usually corresponds with a color. On screen, the functioning cellular automata are a mutating matrix of cells that edge forward in time at variable speed. The mutation of the pattern, while displaying some kind of global organization, is generated only through the implementation of a very limited system of rules that govern locally.

Their most famous instantiation relates to John Conway's game of life as taken up within the domain of generative music by Brian Eno. The focus of such generative music revolves around the emergent behavior of sonic life forms from their local neighborhood interactions, where no global tendencies are preprogrammed into the system. In the software system CAMUS, based on Conway's model, the emergent behaviors of cellular automata are transposed into musical notation.

As in the case of cellular automata and artificial neural networks, models based around genetic algorithms also transpose a number of abstract models from biology, in particular the basic evolutionary biological processes identified by Darwin and updated by Dawkins.[10] These algorithms are often used to obtain and test optimal design or engineering results out of a wide range of combinatorial possibilities. Simulations so derived allow evolutionary systems to be iteratively modeled in the digital domain without the inefficiency and impracticality of more concrete trial-and-error methods. But as Miranda points out, by abstracting from Darwinian processes such as natural selection based on fitness, crossover of genes, and mutation, "genetic algorithms go beyond standard combinatorial processing as they embody powerful mechanisms for targeting only potentially fruitful combinations."[11] In practice, genetic algorithms will usually be deployed iteratively (repeated until fitness tests are satisfied) on a set of binary codes that constitute the individuals in the population. Often this population of code will be randomly generated and can stand in for any-

thing, such as musical notes. This obviously presupposes some kind of codification schema involved in transposing the evolutionary dynamic into sonic notation, which, as Miranda points out, will usually seek to adopt the smallest possible "coding alphabet." Typically each digit or cluster of digits will be cross-linked to a sonic quality such as pitch, or specific preset instruments as is typical in MIDI.

This deployment consists of three fundamental operations that in evolutionary terms are known as recombination (trading in information between a pair of codes spawning offspring codes through combining the "parental" codes), mutation (adjusts the numerical values of bits in the code, thereby adding diversity to the population), and selection (chooses the optimal code based on predetermined precoded fitness criteria or subjective or aesthetic criteria). One example of the application of genetic algorithms in music composition is Gary Lee Nelson's 1995 project, Sonomorphs, which used

> genetic algorithms to evolve rhythmic patterns. In this case, the binary-string method is used to represent a series of equally spaced pulses whereby a note is articulated if the bit is switched on . . . and rests are made if the bit is switched off. The fitness test is based on a simple summing test; if the number of bits that are on is higher than a certain threshold, then the string meets the fitness test. High threshold values lead to rhythms with very high density up to the point where nearly all the pulses are switched on. Conversely, lower threshold settings tend to produce thinner textures, leading to complete silence.[12]

This research intersection between artificial life and evolutionary music usually culminates, when fleshed out, in prototypes of artificial acoustic agencies composed of voice synthesizers, a hearing apparatus, a memory device, and a cognitive module as host to the algorithms.[13] Algorithmic patterns or sets of rules derived from processes of biological evolution are transcoded into digital information that serves as instructions for sound software. The activation of these rules may produce some emergences analogical to biological phenomena such as evolution and mutation.

All of these projects hint at the unpredictable digital contagion, mutation, and proliferation of vibration through code. They sketch an initial outline of the nonhuman agency of artificial acoustic entities. These algorithmic agencies, Kodwo Eshun describes as UAOs (unidentified audio objects).[14] The UAO is a kind of mutant acousmatic or schizophonic vector, a contagious pulse of experience without origin. For Eshun, a UAO is "an event that disguises itself as music, using other media as a Trojan horse to infiltrate the landscape with disguised elements of timeliness and atopia."[15]

But what happens when these viral audio forms leak out of the digital sound lab, beyond the quarantined spaces of sound art and find themselves physical host bodies? Picture, for example, an unholy alliance between sonic branding and the digital sound design of generative music—a situation in which music was able to respond and mutate in order to preempt the movements and desires of consumers. What if these artificial sonic agencies became parasitic, feeding off your habits and quirks, always one step ahead, modulating your needs? Can this predatory urbanism of responsive, anticipatory branding environments within the surround sound of ubiquitous music media itself be preempted by an approach tuned to both the digital and analog contagiousness of sound, or audio viruses? The algorithmic contagion of generative music would be only one aspect of the sensual mathematics monitored by an audio virology. Tracking algorithms across the auditory mnemonics of populations, these unidentified audio objects can already be found infesting the sonic ecologies of capitalism.

1877: Capitalism and Schizophonia 25

Noise, noise, noise—the greatest single disease vector of civilization.
—J. G. Ballard, "The Sound Sweep" (1997)

Contemporary capitalism is accompanied by the colonization of the audio sphere by an epidemic of "earworms," or audio viruses. The concept of the virus as applied to cybernetic culture, from computer infections to the dynamics of "hype," has become generally prevalent, yet particularly under thought in relation to sound.[1] There is now a burgeoning, if problematic, range of discourses that extend from theoretical biology and medical epidemiology, to software programming, cultural theory, marketing strategy, and science fiction, which finds in the virus, biological and digital, so much explanatory potential regarding the nonlinear dynamics of cybernetic culture. Infesting the fissures of the nature-culture continuum, the virus is also at the center of discussions on the aesthetics of artificial life research generally, and specifically in relation to generative music. To understand this ubiquity of the concept of the virus and its relevance to the contagiousness of vibrational events, some initial components of an "audio virology" will be sketched, paying special attention to the microscopic engineering, incubation, transmission, contagion, and mutation of sonic culture.

An initial task in constructing an audio virology is to break with a transcendent view of viruses. Film director David Cronenberg, cinematic fabricator of

the new flesh soft machines of contagious media in films such as *Videodrome* and *Naked Lunch,* assumes a somewhat Spinozist approach to the virus:

> To understand physical process on earth requires a revision of the theory that we're all God's creatures—all that Victorian sentiment. It should certainly be extended to encompass disease, viruses and bacteria. Why not? A virus is only doing its job. It's trying to live its life. The fact that it is destroying you doing so is not its fault. It's about trying to understand interrelationships among organisms, even those we perceive as disease. I think most diseases would be very shocked to be considered diseases at all. It's a very negative connotation. For them, it's a triumph. It's all part of trying to reverse the normal understanding of what goes on physically, psychologically and biologically to us.[2]

This reorientation onto an immanent plane of specific encounters (which can be both constructive and destructive) between bodies, what Spinoza calls an *Ethics,* is opposed to an overarching, transcendent, anthropocentric morality of health. Of course, this all raises the question of why it is more productive to develop the concept of cultural *infection* when there is already a more neutral concept of *affection.* While these terms can often be developed interchangeably, the connotations of "infection" usefully dramatize this conception of the power relations of affective contagion,[3] an aspect that tends to be missing from the dominant cognitive theory of cultural virology, that is, memetics.

Methodologically, an audio virology implies the transcription of the terminology of music markets and antimarkets; individual artists or producers, for example, become carriers, events become incidents of outbreak, scenes become fields of contagion, trade becomes an exchange of contagious sonic fluids or particles, radio becomes a literal transmission network, and acoustic cyberspace, in both its analog and digital domains, becomes an epidemiological field of affective contagion. In constructing this audio virology, it is helpful to track down traces of this notion of sonic infection that reside latent within the discourses of the last century while noting how the digitalization of culture has brought viral microcultures into ever sharper focus. Over the past decade, the emergence of digital encoding formats and decentralized distribution networks has forced a radical rearrangement of global music markets, leading many to proclaim,[4] for example, mp3 as a code weapon in a market warfare against global multinational protectorates: an audio virus, replicating itself across the hard drives of networked computers, unraveling the cell walls of a global antimarket.[5] Elsewhere, recent digital sound design, equipped with its algorithmic instruments and generative methodologies, continues what is essentially an avant-gardist electroacoustic legacy, obsessed with music as process (not product) and

therefore concerned with the integration of chance into compositional practice.[6] More interestingly, its research has provided a vehicle for the arrival of self-differentiating autonomous acoustic agencies and artificial sonic life-forms, unraveling musical form into networked sonic anarchitectures, rendered susceptible to random mutation. In many cases, these sonic algorithms, usually genetic and sometimes viral, are transpositions of bioevolutionary rules into software.[7] But while such digital sound design technologies have facilitated much of this topologization of microsonic form and its exposure to potential mutation, it would be a conceit to attribute too much significance or innovation to these recent formalist technoaesthetic developments.

As predatory brand environments converge with generative music and consumer profiling, artificial sonic life-forms are released from the sterile virosonic labs of digital sound design into the ecology of fear. But what conceptual tools does an audio virology use to track the transmission of these contagious sonic algorithms (earworms) and their psychoaffective symptoms ("stuck tune syndrome" and so-called cognitive itches)? Cultural virologies have to date remained essentially dualist (in the Cartesian sense) and neo-Darwinian in their reduction of culture to a cognitive field composed of static, unchanging idea units, otherwise known as memes. A standard objection to cultural virologies such as memetics is that by attributing so much autonomy to networks of memes, they sideline the human labor and consciousness involved in the construction of culture. Like memetics, the conception of an audio virology is also intended precisely to counter some of the habits of anthropocentrism within auditory thought. Yet it will be clear that the audio virology consistent with the ontology of vibrational force developed earlier diverges from memetics is significant ways. Moreover, if anything, one problem of memetics is that it does not go far enough in this direction. There is a residual transcendence that haunts the cultural cybernetics of memetics. Memetics tends to conceive of culture strictly cognitively, as composed of ideas, beliefs, and values, posing the question: If humans can think ideas, can ideas think humans? Yet it will be suggested that memetics, with its cognitivist obsessions and constant academic inferiority complex, can only inadequately deal with processes of affective contagion and the rhythmic differentiation and mutation of vibrational transmission vectors. Instead, the components of an audio virology will be sought that are capable of mapping the full spectrum of affective dynamics.

It will be suggested that perhaps a more fruitful line of investigation can be found in the broader intersection of sonic culture with the virological

pragmatism, the viro-tactics found in the sonic fictions and processes of the Black Atlantic. Such an upgraded audio virology should be able to assist in approaching the following diagnoses: What is it to be infected by sound?[8] How are bodies affected by rhythms, frequencies, and intensities before their intensity is transduced by regimes of signification and captured in the interiority of human emotions and cognition? What can be learned from the microscale of sound about its global technocultural tendencies, drifts, innovations, and black holes? What viral algorithms are at work within vibrational culture beside so-called generative music? What artificial life-forms inhabit the ecologies of global music markets? How are audio viruses deployed within a politics of frequency?

1976: Outbreak

26

That sound chills your spine. You can't close your ears; you are defenseless. You cover the ears, but your skin is still exposed. You can't see it coming either. Stealthily, insidiously, it wriggles its way toward you, bristling with an unfathomable potential for replication. It wants you. At least, it wants to use you. And then leave. It approaches with the croaking, crackling, chittering, seething intimacy of microbial life. It induces the sonic equivalent of déjà-vu (déjà-entendu?). You are sure that sound is familiar, but perhaps not from this lifetime. Those serrated frequencies have resonated before with some part of your body, and that anomalous recognition testifies to the acoustic memory implant folded in your body, latent, waiting to be reactivated by a future that is filtering in. What's happening?

Exactly one year after the terrorist attacks of 9/11, a text was published in the *New York Daily News* announcing leaks from classified reports from the NASA Medical Research Laboratories detailing new evidence that viral diseases such as AIDS and ebola could be transmitted by visual channels.[1] The idea was that exposure to microphotography of virus structures could, through a process of what was described as "dematerialization-materialization," pass through the retina and the brain and then reemerge as a "substantial living virus," entering a destructive relation with certain parts of the body. The fear, of course, was the potential such a powerful weapon could have in the hands of terrorists. But "if images can be virulent, can sound be virulent too?" This was the question posed by Swedish artist Leif Elggren in his "Virulent Images, Virulent Sounds,"

the project that stimulated the hyperstitional newspaper article. Elggren was fascinated by the direct, immediate implication of audiovisual media on the body. The CD that accompanied the project[2] was presented with eight microstructure virographs (obviously published with a health warning) and contained eight audio recordings of highly potent viruses:[3] HIV, rabies, influenza, lassa, mumps, ebola, sin nombre, and smallpox. According to the sleeve notes, these microrecordings were carried out in a government laboratory in Tripoli, Libya, and couriered to Sweden on minidisc in January 2002. Elggren's epidemiological sonic fiction concerned the transmission of a biological virus code through the channels of media culture, an affective transmission of the abstract virus structure through digitalized ripples of sonic intensity—a transmedia vector scaling up from viral code through the microbiological to the audiovisual, only to compress into code again. Even without this fictional context of mutant DNA, the sounds were pretty creepy: a chittering yet viscous sonic mutation, a sensual mathematics, in the gaps between sound systems, vibration, skin, internal organs, auditory-tactile nerves, and memory.

As with many of Cronenberg's films, Elggren's Virulent Images, Virulent Sounds project resonates with the cut-up conceptechnics of William Burroughs. Elggren's version of audio virology seems based on the infamous 1970–1971 text *Electronic Revolution,* his manual for the use of audiotape cut-ups in instigating crowd violence. Burroughs amusingly outlines a series of tactics: from spreading rumors in order to discredit political opponents, to using sound as a frontline practice to incite riots. Cutting in a range of incendiary clips, at a parable level of intensity to the ambient sonic environment so as not to attract the conscious attention of the crowd, Burroughs suggested that the behavior of the crowd, through a kind of mood modulation, could be steered in certain directions. "There is nothing mystical about this operation," he stated, "recorded police whistles will draw cops. Recorded gunshots and their guns are out."[4] Burroughs goes on to ask wryly whether a virus "is perhaps simply very small units of sound and image. . . . Perhaps to construct a laboratory virus we would need both a camera and a sound crew and a biochemist as well."[5] Here Burroughs initiates what will become a recurrent refrain of the cyberpunk science fiction of the 1980s and 1990s: the virus as the anomalous entity trading between nature and culture, as at home in the human animal as it is in machines. As Douglas Kahn points out in *Noise, Water, Meat,* Burroughs's virology implies a mnemonics, or theory of memory, that relies on ideas he repurposes from L. Ron

Hubbard's notion of the engram,[6] which in turn relied on early-twentieth-century psychologist Richard Wolfgang Semon's concept of the mneme.[7] As Kahn describes it, the engram was basically

> an injurious or otherwise painful moment literally recorded by the body. This recording should not be confused with memory that takes place in the brain, and it should not be assumed that a person even needs to be conscious to record an injurious experience. Instead the recording occurs anywhere in the body at the cellular level as a "definite and permanent trace left by a stimulus on the protoplasm of a tissue . . . a cellular trace or recording impinged deeply into the very structure of the body itself." These engrams contain absolutely everything and would be very much "like phonograph records or motion pictures, if these contained all perceptions of sight, sound, smell, taste, organic sensation etc." If these engrams stay in place and are not discharged through therapeutic means, they will predispose the individual to psychosomatic illnesses . . . mental disorders and always something less than complete psychophysiological sanity.[8]

The connections, which Kahn follows from Burroughs's word virus back through Hubbard (to Wilhelm Reich, Alfred Korzybsky, and Richard Semon), open an interesting, anti-Cartesian portal onto an audio virology, that is, the need to conceptualize memory outside merely cognitive process, at the level of the enfolding of affects into the body. However, the hardware storage model of memory, in which it is thought that memories are stored in a particular location in the body/brain, is controversial and has been consistently attacked from the early twentieth century in philosophy and psychology. Other resources must be turned to in order to construct an audio virological tool kit that can more convincingly account from sonic processes of affective contagion.

The quasi-discipline of memetics proclaims itself as a field of expertise in the study of cultural viruses. A strong neo-Cartesian undercurrent connects memetics with artificial intelligence research as manifestations of the desire to digitally simulate human thought and culture. The term *meme* was coined by theorist of evolution Richard Dawkins. In his most infamous text, *The Selfish Gene,* Dawkins constructs the term to function in relation to culture in the same way that the gene functions in relation to biology.[9] As the gene is the basic informational building block of biology, the meme for Dawkins stands as the basic unit of culture: "Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation."[10] Of course,

Dawkins acknowledges that there are significant divergences between the process of genetic or biological transmission and that of memetic or cultural transmission. He therefore qualifies the comparison by drawing attention to the fact that genetic information is passed down the tree of genealogy; transmission is hereditary. Cultural or memetic transmission, on the other hand, is transversal, cutting across the vertical axis of the genetic flow of information, and is therefore more viral than genetic. On one level, it is all just DNA code, but what crucially distinguishes them is their orientation to futurity, their path to the future. As Dawkins points out in his essay "Viruses of the Mind," "Legitimate host DNA is just DNA that aspires to pass into the next generation via the orthodox route of sperm or egg. 'Outlaw' or parasitic DNA is just DNA that looks to a quicker, less cooperative route to the future by a squeezed droplet or a smear of blood."[11]

For Dawkins, the meme is not just a metaphor, of culture merely mirroring the processes of nature. Rather, he suggests, there is a deep isomorphism between certain natural and cultural processes. To be exact, the isomorphic process is replication. Memes are nongenetic pattern replicators. Dawkins, in the "Viruses" essay, points to the three characteristics of successful replicators that he terms copying fidelity, fecundity, and longevity. Copying fidelity relates to the quality of the copying process. The less degradation of the pattern after several iterations, the more successful is replication. Obviously a faster rate of copying will accelerate the replication process. Finally, the more reliable the material holding the pattern, the longer the pattern is likely to last, thereby extending its potential of abundant future replication. Dawkins focuses on computer viruses as an intermediary in connecting nature to culture, wiring together biochemical machineries to brain replicators through networked hard disk memory. As a model of informational epidemiology, computer viruses are computer programs written with the power of self-duplication, and therefore the ability to spread: in other words, they contain the instructions "duplicate me." Dawkins, as in Elggren's "Virulent Images, Virulent Sounds" project, emphasizes the role of memetic transduction: "Viruses aren't limited to electronic media such as disks and data lines. On its way from one computer to another, a virus may pass through printing ink, light rays in the human lens, optic nerve impulse and finger muscle contractions."[12] Yet for Dawkins, while the brain is more susceptible to errors, it is only quantitatively less conducive to successful replication than cells or computers.[13]

While memetics provided some useful conceptual machinery for formulating the evolution and spread of cultural viruses, it has a number of preprogrammed

limitations that curtail its contribution to an audio virology. The first problem derives from Dawkins's insistence in differentiating science from a cultural virus. Dawkins really wants to retain the negative connotation of the "virus," using the term specifically in relation to what he considers dangerous infections of the mind—for him, most notably, religions. Danger, for Dawkins, relates to nonscientific cultural domains. He retains a transcendent position as scientist,[14] aloof from the virological field of cultural transmission. He does admit that science is itself composed of memes but not of the insidious variety. The deficiency of memetics is that the memeticist remains aloof, transcendent from the epidemiological field. It is almost as if Dawkins has been immunized to the very viruses he discusses.

The second, and related, problem stems from the tendency of memetics generally, and Dawkins specifically, not to differentiate rigorously enough among different types of replicators. Manuel De Landa, for example, in *One Thousand Years of Nonlinear History,* differentiates between an array of nongenetic replicators, a term he prefers to *meme.*[15] Although Dawkins's desire is that the relationship between the meme and gene be more than a metaphor, De Landa maintains that the lack of precision in the definition of replicators weakens his case. For De Landa, memes are confined to transmission by imitation (copying as a means of propagation—for example, bird song, fashions, fads), while on the other hand, there are what he describes as enforced replicators, or norms.

Third, memetics is primarily obsessed by information and its centralization in the brain, at the expense of flows of matter and energy and distributed bodily intelligence. Its cognitivist philosophy remains ensnared in the Cartesian legacy of Western thought, leaving no room for the body, movement, and mutation. For us, memetics falls victim to the Spinozan critique of Cartesian metaphysics. Spinoza's parallelism, his alternative to dualism, makes possible an understanding of mind-body infections in a way that takes into account flows of matter and energy as well as information. While for Descartes there are two substances, thought and extension, for Spinoza there is only one substance (also known as nature and the entity or, for Deleuze and Guattari, the plane of consistency, the Body without Organs, abstract matter, or the virtual). Spinoza's substance has an infinite number of attributes, only two of which are accessible to the human. But rather than being separate, thought and extension for Spinoza are two aspects of the same substance. A Spinozist approach to cultural viruses would therefore have to discard such narrow cognitivist approaches to culture in favor of affective contagion.[16] For Whitehead, on the other hand, discarding Spinoza's

monism in favor of multiplicity, affective contagion is marked by the potential of an actual entity to enter into the concrescence of another actual entity.

De Landa wishes to distinguish specific types of cultural genotypes or replicators (for example, memes or norms) from cultural phenotypes (interactors like enzymes that serve to actualize abstract patterns or, in language, speech acts that lead to the switching from one state to another) in order to deal with the flow of material through which nongenetic replicators spread. When the transduction potential of cultural viruses is taken seriously, the focus can no longer purely remain on the informational state of this process. Memetics, by tending to focus on the transmission of information patterns across the meme pool of brains, a cognitive network, pays insufficient attention to issues of affective contagion and the propagation of physical and mental vibration.

An audio virology, on the other hand, entails a nexus that synthesizes the flows of information, matter, and energy into a virulent rhythmic consistency. In such an assemblage, it would be impossible to conceive of the replicator in isolation, but rather embedded in an ecology, a diagram of relations to its material environment. This relation between the replicator and the sorting functions carried out by selective environmental pressure forms a blind probe into the potential mutations of an entity, not merely an informational pattern. And it is this relation, what De Landa calls a "virtual searching device," that makes possible the transversal trajectory of cultural viruses across a range of material and energetic platforms.

Fourth, it is very hard not to construe memetics, in its dominant manifestations, as reductionist. By analyzing culture in terms of populations of unchanging idea units, little room is left for change and mutation, and no account is provided of the formation or constitution of these elementary atoms. If we probe the submemetic level, shifting the preoccupation of memetics with units onto the relations that comprise them, then these atomic components of culture reveal and are traversed by a more primary field of rhythmic vectors. The replicator would therefore become a rhythmic assemblage, an entity composed of speeds and slowness, clusters of sensation, percepts, and affects. What is depicted as a meme therefore is always already a population.

If the atomic basis of culture is to be insisted on, then it would have to be modeled on a more Leibnizian schema, such as that followed by Gabriel Tarde, or it would resonate with the way Whitehead subtracts monism from Spinozism, pushing it toward a multiplicity of quasi-monadic actual entities.[17] If culture is to be formulated in computational terms as a *monadology,* then the base

components must be able to evolve, change, and involve. The key questions become: What is enfolded within these cultural units? What submemetic populations do they conceal? Where are the networks of transmission in this story of arithmetic units? An audio virology constitutes a kind of sensual mathematics that moves past the transmission of unchanging units toward a model of the unit of replication that mutates with each copy. This orientation operates at the apex of divergence and movement—a parasitic, divergent vector that has been understood, following Lucretius, as the angle of the swerve, the clinamen. It is therefore necessary to go beyond memetics, beyond the distinction between meme and transmission network, to understand an audio virus as affective vector, where the meme is unfolded onto its outside, becoming flat with its trajectory and environment topologically. To focus in this way on the becoming other or mutation of the meme as it passes across a transductive circuit unlocks the surplus potential immanent to the unit. Difference and mutation take priority over the repetition of the same. The shift from memetic to rhythmic contagion involves conceiving of the (extended) brain, as rhythmic transducer, converting extensive movements into pulse patterns passing through neurological circuitry. Memes are material processes, not merely informational patterns but specific patterns of synaptic resonance across neural networks. The shift to rhythm leaves open the content of the replicator to divergence. The brain's rhythmic circuitry revolves around the pulsing behavior of billions of networked neurons. These rhythms can actualize as an array of bodily movements or sensations. But again, transmitted pulse patterns are not fixed or unchanging, but rather are subject to perturbation from the quantum scale, appearing as generative noise, injecting new information to destabilize repetition.

In summary, a memetics must be supplemented in order to construct an audio virology. Memetics fails to fulfill the necessary criteria in that it neglects to account for the body, affect, and change and therefore cannot adequately analyze the sonic "softwar" strategies at work in contemporary capitalism. Elsewhere, the operating logics of sonic branding help fill out the picture a little. While this emergent field seems to run on memetic cultural software, its market-driven pragmatism leads it to loot insights from emotional neuroscience spliced with a crude behaviorist psychology. Its tactics reveal much about the viro-sonics of capital, engineering self-propagating vectors of contagious sound, unleashing a population of predatory "earworms" into the public domain.

27
1971: The Earworm

It's 3.09 A.M. You were asleep, dreaming. Eyes closed, pulsing with inverted activity, ears gaping, vulnerable as always. You spasm up from the darkness. Your eyes open, focusing on the fluorescent digits of the wake-up machine. Something has changed since you went under. You are no longer alone. Something has arrived and entered. You think you saw it, or them. A pack of them, wriggling through the radio waves. Maybe that was just the motion blur of the digits on the clock radio display, as you jolted your head to hunt the intruder. But no sign. Just a chain of sounds, muffled, wordless, timbreless from deep down in the throat chamber. Perhaps less than a sound, a string of resonance effects. Not yet a tune, but with some divergence in frequency. Unnamable, an entity has folded itself into your gray matter. It has hooked you, staging a pirate attack on your vocal chords. It needs you to replicate, and it's begun already, sounding you out. What happened? You've been infected by an earworm: a tiny microbe or rather micro-riff—a spiraling, coiled vibrational loop. Later today it will be spending your money while you're singing its tune.[1]

In 1984, Klaus Maeck's and Muscha's paranoid, low-budget, post-punk movie *Decoder* explored the potential of sonic weaponry deployed against the forces of Control. Against the backdrop of immanent nuclear annihilation, the film describes a world where all that is left for youth to do is to dismantle it. In the film's Manichean vision, Muzak, as the concoction of doctors, musicians, and marketing experts, aiming to stimulate productivity and employee morale alongside generating a pacifying glow of comfort in the consumer, represented by the ultimate, insidious musical agent of evil.

The film develops a number of sonic concepts revolving around a confrontation between Muzak and a kind of counter-Muzak. The lead character, FM, experiments with sonic techniques to intervene into the piped musical environments of consumerism. Set in Hamburg in the early 1980s, FM is a reclusive, alienated youth who spends his time experimenting with recording equipment in his studio. The film follows the awakening of FM, who one day grows very suspicious of the ever-present Muzak played in his local hamburger restaurant. He suspects that the Muzak is controlling consumers and starts to hear subliminal messages within. He begins to record the Muzak to analyze it and starts producing his own form of "anti-Muzak" by manipulating his recordings, changing their speed, reversing them, or layering them with the sound of riots and animals. While roaming the city, he meets an underground cultish group named the "pirates" engaged in dark-side "black noise" rituals. FM ends up joining forces with the "pirates" and conducts attacks on Burger Kings and McDonalds equipped with their cassette players loaded with anti-Muzak, inducing nausea and rapid evacuation of the fast food restaurants. In response the Muzak Corporation sends a secret agent to hunt down the sonic terrorists. Meanwhile, social disorder escalates as FM and his allies in the "pirates" reproduce and distribute their anti-Muzak cassettes.

The riot scenes featured in *Decoder* were the actual riots filmed during President Reagan's early 1980s visit to Berlin. According to *Vague* magazine in 1984, the film crew intended to plant actors with tape recorders in the crowds during Reagan's visit. On location, they noticed that local anarchists were already handing out tapes (with instructions for playback and replication) of war sounds such as approaching helicopters and random gunfire to stoke up the crowd's anger and produce disorientation. In fact, the police had already begun confiscating tape recorders. Klaus Maeck described that it was a kind of game: "Whenever the Police were going to another area, we had time to think of something new to get them back into action. We placed tape terrorists—friends holding tape recorders—to get footage for our film wherever the action was."[2]

The film featured an underground yet star-studded cast including William Burroughs, Throbbing Gristle's Genesis P. Orridge, and Einstürzende Neubauten's Mufti. But more than anyone else, Burroughs's writings seem to have been the primary conceptual guide to the cut-up techniques promoted in the movie, particularly his ideas from *Electronic Revolution* that described the use of tape-recorders to sonically catalyze riots and crowd disturbance. Burroughs appears in one dream sequence of the film (playing the part of a shopkeeper dealing

in spare electronics) to pass the main character an audiocassette. Like Leif Elggren's CD project *Virulent Images, Virulent Sounds, Decoder*'s tape terrorism seems to stem directly from passages that describe the contagious use of the tape recorder.[3]

Muzak, since its birth, has often been referred to both as "functional" and "background" music.[4] Its description as background music, however, has always signaled an ambiguity between the organization of sound thought to be typical of Muzak and that of music that demands more attention or merits more aesthetic worth. This ambiguity revolves around the overlap between "background" music and what has come to be known as "ambient." Continuing the mutability of Satie's "furniture music" in the 1920s onward, "ambient," it has been claimed, can fluidly shift from background to foreground and vice versa, and perhaps undermines this distinction. But the credit for this blurring should not merely be attributed to the cultural influence of ambient music but points to a shift in modes of audition within a broader operative logic of power. If we follow the strategic shift in the Muzak corporation, for example, it appears that, according to Annahid Kassabian, by the mid-1980s, background music had become foreground music in that what was being piped into environments of consumption and labor was in fact generically understood as foreground music in other contexts. There was nothing that necessarily differentiated music and Muzak any longer.[5]

Kassabian, then, describes a mode of ubiquitous listening that corresponds to a mixing of foreground and background, a mode in which listening becomes a parallel process among others in a saturated media environment. According to Jean-François Augoyard and Henri Torgue, the sonic condition of ubiquity pertains to an "effect linked to spatio-temporal conditions that expresses the difficultly or impossibility of locating a sound source. In the major variant of this effect, the sound seems to come from everywhere and nowhere at the same time."[6] Flat panel speaker technology migrates from military research and proliferates into the everyday.[7] Vibration research ensures a ubiquitous media environment in which any surface whatever, organic or nonorganic, becomes a potential emitter of sound. Whatever the specific genre of music deployed now, Muzak—often similar to, often the inverse of the attention-grabbing tactics of sound in radio, TV, and film advertising—still promotes a specific politics of frequency. This revolves around the subtraction of very low and high frequencies (like the perceptual coding involved in mp3 compression), mono playback, the deprioritization of vocals, and often heavy compression to create a continuity in

and minimization of dynamic range. In the history of ubiquitous music, in fact, Muzak preempted our submersion into a generalized surround sound culture, the insidious purr of control and the digital modulation of affective tonality that smoothes the experience of the ecology of fear. As such, it is only fitting that Muzak Corporation now brands itself as providing an "audio architecture."[8]

Early Muzak combined the so-called Hawthorne effect,[9] in which workers would increase productivity when they were aware that they were under surveillance, with the James-Lange theory in psychology,[10] which pointed to the autonomic affects of music in modulating physiological responses such as breathing, metabolism, pulse, blood pressure, energy levels, and galvanic skin response. The effect, it was thought, was to slightly increase productivity while subtly maintaining the attention of the labor force during lull periods in the workday. According to Sumrell and Varnelis in *Blue Monday,* the shift to ubiquitous music and audio architecture in relation to Muzak marks a transition in operative logic that they refer to as from stimulus progression to quantum modulation. Emerging during World War II, stimulus progression tactically organized the day around the pulsing center of gravity of the human heartbeat at roughly seventy-two beats per minute. Increasing and decreasing tempo across the day could therefore produce intensification or disintensification. Alternating between music and quiet would produce alertness by the oscillation between silence and arousal. From the mid-1980s onward, Muzak's strategy of sonic intervention shifted as a response to the already sensorially overloaded environment. Muzak in this sense provides a sonic microcosm of what Deleuze described as the shift from disciplinary societies to societies of control. From the surveillance of stimulus progression that constituted an early form of sonic discipline by Muzak, to the horizontality of background, atmospheric control in quantum modulation that no longer needs to correct individual action directly. Quantum modulation affects mood rather than just trying to manipulate attention. In addition to modulation, Muzak, as audio architecture, helps to mask the babel of consumption in the polished postmodern surfaces of the shopping mall, airport, and other "non-places." Whereas stimulus progression varied intensity and mood in the music, quantum modulation numerically indexed music in relation to qualities "such as tempo, color (light or dark), rhythm, popularity and so on to ensure that the *same intensity can be maintained even as the music appears to have changed.* Atmospherics address individuals as they traverse different ambiances through their everyday lives[my italics]."[11] Quantum modulation

therefore, simulating the logic of the DJ, attempts a smooth affective control by creating a plateau of musical intensity.

However, the question pertains as to whether the contemporary nexus of viral marketing and sonic branding extends beyond control as modulation into a mode in which preemption attains a new autonomy. The "hard sell," the "soft sell," and immersion in the immaterial haze of a brand environmentality all deploy techniques of suggestion to induce consumption of a product. In preemptive power, however, a product does not necessarily preexist the contact between brand and consumer. Rather, the contact in terms of the viro-sonic production of allure serves to produce memories of contact with products that do not yet exist. When capital becomes speculative in this way, it forces critical analysis onto the same speculative terrain. Audio virology takes some initial small steps toward this speculative method. The submerged affective sensorium in which ubiquitous listening is now a subset compels the transformation of outmoded frameworks of sonic thought. In an attempt to perform the necessary upgrade, an audio virology starts from the premise of a mode of audition that is "always on." As with all other continuously open network connections, the body becomes vulnerable to viral contagion. If Muzak as sonic architecture preempted the environment of ubiquitous audition in which consumption is now routinely submerged, then sonic branding and its genealogy traceable to radio jingles aim to catalyze the motivation to consume, creating a sonically triggered tipping point. A brand comprises both actual and virtual relations, influencing the patterning of activities, rhythmically distributing them in time and space. A brand functions as a nexus, holding together a set of relations while maintaining, by iterated feedback, a dynamic unity in an environment of product differentiation and brand integration. On its concrete side, in extension, the brand faces actual products quantitatively registered with prices. In its abstract dimension, it expresses intensive qualities. The virtual dimension of the brand acts as a device generating and congealing an aura of associations extending to the horizon. The brand nexus acts as a relay or filter between consumers and producers, diagramming their interrelation, managing the interval between contact. The positioned logo, sonic or visual, allows the brand to intervene in a field of perpetually shifting products, producing and sustaining a relation where there may have been none.

In a dual strategy that makes use of the new technologies of ubiquitous media to mesh viral marketing and sonic branding, the brandscape is becoming

increasingly predatory. Brands close in on you from the future, locked into your affective sweet spots, laying an array of seductions, traps, diversion, bluffs, and decoys. Branding has gone preemptive in the move from product to pattern, swooping down to capture the interval between code traces and network profiling. This is the full-spectrum dominance of multidimensional synesthetic branding, operating in the gaps between sound, sight, touch, taste, and smell. In 2001, the *London Financial Times* described how "having conquered the visual world of logos . . . [brand consultants] are now embarking on an aural attack. Sonic branding is all the rage." In an era in which two seconds of sound strategically attached to a brand is the equivalent of a heat-seeking technology programmed into a missile's guidance system, sonic branding becomes a targeting device of increasing power, guiding commodities toward the libidinal demographic hot spots at which they are fired. One consultant from a brand agency, Identica, explained, "We will always invent a sonic logo, for those times when you can't see, touch or feel the brand."[12] Sonic branding therefore becomes a tactic of softwar, power through audio seduction.

Some interesting recent research related to sonic branding revolves around a strangely common psychoacoustic condition. At the forefront of this research is branding psychologist James Kellaris, who has been dissecting earworms, unraveling their slight bodies to investigate their basic affects.[13] For Kellaris, earworms cause a neurodisturbance that he terms "stuck tune syndrome," the effect of a seemingly innocuous piece of music lodging itself into the brain and refusing to leave. Kellaris has noted that certain types of music (particularly anomalous stimuli) operate as "mental mosquito bites." They create a "cognitive itch" that can be scratched only by replaying the tune in the mind. The more the mind "scratches," the worse the itch gets. Using terminology close to memetics, Kellaris talks of conditions such as "stuck tune syndrome," which describe earworm infection. Musically, the primary vector of earworm transmission is what is referred to as the *hook*. But how do hooks hook? What is the affective dimension of sonic branding? How does an earworm worm its way into your memory to replicate?

Of course, the cultural industry symbiotically intertwined with branding and advertising, and that makes its everyday business the engineering of audio viruses is popular music.[14] Advertising has learned much from the success of popular music's viro-tactics of hook engineering. In 2001, Kylie Minogue's "I Can't Get You out of My Head" captured this potency on two levels as her voice intensified the insinuating refrain. In the economy of attention and dis-

traction of viral capital, marketing force fields traverse bodies from every angle, implanting earworms. Earworms are the virological vectors onto which sonic branding latches. The term derives from the German *ohrwurm* (an infectious musical agent). A commonly cited species within memetics, the earworm is the catchy tune that you cannot get out of your head, the vocal refrain, the infectious rhythm or the addictive riff. There are many species of earworms traveling at different speeds through the epidemiological field of sonic culture. Kodwo Eshun registers the programming of the alien earworm precisely: "an audio-insinuation that seeps into the ears and taps out mnemonics on its drums. It smirks, sated—because as soon as you drop the needle on the track, you're in its domain. Now you're there its 'doing it in your ear hole.'. . . It's talked you into letting it molest your sensorium."[15]

According to sonic brand experts, suggestions for the removal of earworms are few and far between. The limited repertoire usually includes techniques for removal such as substitution, completion, donation, and extraction. Substitution implies a resignation to the fact that there is no escape from the parasitic earworm, so all one can do is attempt to usurp the reign of one refrain with that of another, perhaps less irritating to the host—a simple replacement. Completion involves the host of the earworm listening to the piece of music from which it escaped in full. Of course, not all earworms are susceptible to such techniques, and completion comes with the added danger that repeated playing makes innocent passers-by vulnerable to infection. This approaches the logic of donation, where a host will deliberately voice the earworm in the hope that it will take the opportunity to pass through and attach itself to a more welcoming body. Finally, the extraction of an earworm, thought to be the most effective, can be attempted. The first stage is to identify the strain of earworm. This is not an easy task, often complicated by a related condition to earworm infestation, the side effect of *déjà entendu,* that is, partial recognition of something heard but corresponding to the inability to attribute cause or location to the source of that sound effect. Extraction, once identified, involves some of the earlier techniques just described, followed by the analysis and dissection of the worm until it loses its virulent potential. Again, this is a risky strategy, as analysis always presupposes a potential escalation in the intimate relationship between host and parasite.

Sonic branding entails an intervention into the affective sensorium's mnemonic system. It can be considered a program for modulating the auditory nervous system through contagious vibration. It is obvious to self-proclaimed

experts such as Kellaris that they are dealing with potent (and clearly very lucrative) material. Therefore, it is not too surprising that he does not seem overly concerned with the pragmatics for removing earworms, although he is with their implantation, the fabrication of branded memory, a second skin channeling processes of desiring production. It is a brain program, as one sonic branding memory consultant, Duane Sprague, has outlined:

> In short, the actual process of branding is the result of using echoic memory recall (the memory of things heard) to implant an associative memory (a new memory you create with your specially created branding message), that has become linked to a positive memory already anchored in the individual's mind, and then recalling that anchored memory on demand (and thus the desired response) with a recall cue or stimulus (your branding ad which is the associative memory now linked to the anchored memory). . . . Therefore, the hearing of your branding ad, which is the recall cue, and also the new associative memory, automatically pulls-up the pre-existing anchored memory. Because this anchored memory is positive, a positive feeling is associated with your [brand] name upon hearing the cue. . . . Branding can also be achieved using iconic memory as a recall stimulus (memory of things seen), but this is much more difficult, time consuming, and expensive, as the human brain is easier to train and condition using the sound of words over sight alone. To the brain, spoken words seem to carry far more emotional impact than written words. And the greater you can make the emotional impact, the deeper rooted the associative memory, or recall stimulus becomes. The deeper rooted the associative memory becomes, the easier and more reliable it is to stimulate on demand, and the more likely to be permanently linked to the desired anchored memory.[16]

It is misleading, however, to suggest, as Sprague does, that the most potent level at which such sonic mnemonic processes operate is the level of associations, of significations through spoken words. Another more basic dimension is suggested if you follow advertising's evolution from the rather crude bioweapon of the jingle in the 1950s to the current attempts at ubiquitous immersion of sonic branding, with its armory of nonverbal "earcons," "sonic logos," and "idents."[17] A catchy tune is no longer sufficient; it merely provides the DNA for a whole viral assemblage.

Instead of an outmoded associative psychology, most branding theory has already moved on to invest in the modulation of emotion by nonverbal means, signaling a mutation of capital logic into a more subtle colonization of memory through the preemptive sonic modulation of affective tonality. The symptoms of such a shift of power are manifest in acoustic time anomalies. Analyses of these glitches reveal much about the way in which sound hooks.

2025: Déjà Entendu 28

Whoever experiences it is often prey of a characteristic emotion, becoming more or less a stranger to himself and, as it were, "automatized."

—Henri Bergson, "Memory of the Present and False Recognition" (2007)

What concept of memory could account for the contagious vibrations of audio viruses without denigrating them to mere epiphenomena? What concept of memory is compatible with the illogic of affect, the virtuality of the past and the active immanence of futurity in the present? In a chapter in his book *Emotional Branding,* essentially a "softwar" manual for brand consultants, Gobé describes the power of sound to abduct you to another time, to activate memories that obliterate consciousness of the present in front of you, in the blink of an eye, transporting you into previously overpowering sensations and affects.[1] The potency of earworms is not limited to contagiousness. When audio viruses resonate in the host body, they can result in the feeling of temporal anomaly. If we assume that instead of an exception, synesthetic perception is primary, then earworms use the full body as an ear, treating the skin as an extended eardrum membrane. They seem to possess the ability to implant themselves through an achronological looping in which distinctions between past, present, and future compress and come into contact. The earworm enters by creating a time anomaly as its Trojan horse. This entry only becomes manifest secondarily as a microtemporal, fleeting glimpse of recognition. We could say, perhaps only half jokingly, that it enters in this split second through an *earwormhole.* The

second-order effect of (illusory) familiarity or recognition temporarily pulls down sensory defenses. In other words, in that momentary flash, an instruction is communicated—record me! The flash abducts us into a past, potentially fictional but real, in that it forces an attitude of receptivity by compelling a vacation from the self—or, rather, a takeover of the body by an exterior entity, an audio virus programming your desire. Branding increasingly makes use of such memory glitches in which the distinction between past, present, and future becomes blurred.

Film sampling in electronic music illustrates one aspect of this mnemonic problematic. A sense of familiarity, or déjà vu, is often experienced when you watch a film that contains a segment of sound—it could be a phrase or even merely a tint of ambience—that you first experienced in its sampled form in electronic music. The affective charge of such a memory involves a reduction from audiovisual data to just audio. For Kodwo Eshun, following Michel Chion, this compression of the affect is felt as temporal abduction, chronic infection. These flashes have, as he astutely notes, the power to generate the sense of "always being grabbed away by the music. By extinguishing the visual output, the music is switching it on elsewhere. It's as if the eyes started to have ears."[2] In this process of switching, a synesthetic surplus value is produced, and it is this surplus that makes acoustic time anomalies in sampladelic culture such a common occurrence. The more commonplace version of this involves accidentally stumbling across an original track when you are much more acquainted with its sampled riffs or vocal phrases populating another piece of music. The history of funk and reggae in particular reverberates with the trauma of perpetual looting from hip-hop, jungle, and other forms. The already occurred "abduction by audio" is felt retrospectively as a vague sense of familiarity that switches on your pattern recognition systems, "presses record," and intensifies your vulnerability to infection. The body, then, a vibrational nexus and cross-sensory transducer, records and plays back, is affected and affects, is infected and infects.

An audio virology clearly opens up more questions than it can answer. How should it conceive of the relation between the body, memory, and perception? How does a (perhaps illusory, a false memory) sense of sonic familiarity render a body susceptible to sonic infection? To unravel this phenomenon of déjà entendu, a symptom of the condition of schizophonia (i.e., sounds detached not just from their sources in space but also in time), we need a sense of memory in which the past and the future virtually coexist with the present so that memories and anticipated potentials resonate with each other in unpredictable ways. The

implied assertion is that auditory hallucinations play an increasingly complex role within a cybernetic capitalism of ubiquitous media seething with artificial sonic life-forms. What is required is a rhythmanalytic cartography that can map vectors of affective contagion through time loops connecting the past and the future.

In his text *Bergsonism,* Deleuze explores duration at various tensions, states of relaxation and contraction, and its relation to the virtual coexistence of affects from different times. He notes,

> We have great difficulty in understanding a survival of the past in itself because we believe that the past is no longer, that it has ceased to be. We have thus confused Being with being present. Nevertheless, the present is not; rather, it is pure becoming, always outside itself. It is not, but it acts. Its proper element is not being but the active and the useful. The past, on the other hand, has ceased to act or to be useful. But it has not ceased to be. Useless and inactive, impassive, it IS, in the full sense of the word: It is identical with being in itself.[3]

In this sense for Deleuze, the

> past is "contemporaneous" with the present that it has been. . . . The past and the present do not denote two successive moments, but two elements which coexist: One is the present, which does not cease to pass, and the other is the past, which does not cease to be but through which all presents pass. It is in this sense that there is a pure past. . . . The past does not follow the present, but on the contrary, is presupposed by it as the pure condition without which it would not pass. In other words, each present goes back to itself in the past . . . it is all our past, which coexists with each present.[4]

Only with such a conception of memory is it possible to admit the affective reality of both sonic memories and premonitions haunting the present. To the extent that sonic branding plays with déjà entendu, it mixes and blends two sonic effects in particular: the effect of a sound triggering a memory of another sonic time and place, and the effect of mentally produced sounds conjuring up imagined experiences. Mixing these concrete and abstract sonic memories, a sophisticated predatory sonic branding would transduce these actual and virtual pasts into anticipatory orientations to futurity. Augoyard and Torgue describe these two sonic mnemonic effects as *anamnesis* and *phonomnesis.* They describe how anamnesis is an "effect of reminiscence in which a past situation or atmosphere is brought back to the listener's consciousness, provoked by a particular signal or sonic context. Anamnesis, a semiotic effect, is often an involuntary revival of memory caused by listening and the evocative power of sounds."[5] Anamnesis, for them, therefore constitutes the opposite of anticipation where the affective

sensorium opens to an event suggested by a passing sonic sequence. Phonomnesis, on the other hand, refers to "a sound that is imagined but not actually heard. Phonomnesis . . . is a mental activity that involves internal listening: examples include recalling to memory sounds linked to a situation."[6] The way in which déjà entendu converts these two mnemonic effects into an orientation to futurity reveals much about the ambience of preemptive power.

While Bergson is concerned with the virtual past, Whitehead's insight here comes from the opposite direction: the potential future. He maps the retroactivity of futurity by focusing on the microtemporality of the immediate present. Memories for him exist between the immediate past and the immediate future. Here, the past does not determine the future but eats into it. In such achronological causation, the future is active in the present, unfolding in the process by which the past-present enters the present-future. He suggests that to prehend the transition between the immediate past and the immediate future is of the order of short-term intuition—time spans that last a second or fraction of a second—"which lives actively in its antecedent world."[7] Prehensions are microtemporal modalities of perception defining not only the conceptual feeling of past occasions in present experiences, but also the way the objective existence of the present lies in the future. Conceptual prehensions indicate not that the past predicts the future, but that the future is anticipated in the present. As Whitehead argues, "Cut away the future, and the present collapses, emptied of its proper content. Immediate existence requires the insertion of the future in the crannies of the present."[8] Prehensions establish a causal relation between the subject prehending and the external world at the moment of perception. Yet causality here enters a multilayered architecture of durations, where past, present, and future are temporal intricacies of the perishing and onset of actual individual occasions.

To remember, then, for Whitehead, entails a cyclical yet nonlinear dynamic whereby an occasion of experience is initiated in the past, which is active in itself and terminated in the future, which is also active. Such an occasion itself starts as an effect facing its past and ends as a cause facing its future.[9] If the present emerges from the past, at the same time it is also immanent to the future. The reenaction of the past passes through the acquisition of the new to be accomplished in the present, yet the content of the present remains the future. Completion is also anticipation. Anterior future: the present remains at once occupied by the past and the future. The memory of the past experience enables the system to learn—accumulate data—to be better equipped to face

the probabilities of future experience. On the other hand, prehensions tackle a universe of microtemporalities, enabling the future not to be predicted by means of probabilities but to actively occupy the present by means of immediacy. "In this sense, the future has objective reality in the present. . . . For it is inherent in the constitution of the immediate, present actuality that a future will supersede it."[10] Whitehead defines this temporal immediacy as the enjoyment of the present: an open-ended enjoyment of reenaction and anticipation where the future enters the present once the past has perished so as for futurity to populate the present anew.

Preemptive power seeks to colonize this activity of the future in the present. Anticipative branding culture, for example, sets out to distribute memory implants, which provide you with the sense of the already enjoyed—already sensed—to encourage repetition of consumption, a repetition of a memory that you have not had. This strain of branding is at the forefront of crystallizing memories of the future—memories that are only virtual despite their sense of familiarity. Such speculative techniques generate an atmosphere of time anomaly crowding the mediatic sphere. The body feels the activated sensation as past. In its infinite differentiation of product ranges, branding plays with a combination of familiarity plus novelty, a past-futurity, installing new memory that you have not phenomenologically experienced in order to produce a certain receptivity to brand triggers. No longer relying on lived bodily experience—actual sensory responses—brand memory implantation operates through the body's remembering a virtual sensation. In short-term intuition, the future yet to be formed is actively populating the sensations of the present, anticipating what is to come, the feeling of what happens before its actualization. Preemptive power therefore invests in the contagious virtual residue of memory. The sonic mnemotechnics of capitalism modulate future desire by activating the future in the present.

1985: Dub Virology 29

Rhythm is a biotechnology.

You are the newest mutants incubated in womb-speakers . . . the labs where the 21st C nervous systems assemble themselves.

—Kodwo Eshun, *More Brilliant Than the Sun* (1998)

An alternative approach to the audio virology of ubiquitous music of sonic capital derives from an analysis of the sonic processes and fictions of what cultural theorist Paul Gilroy called the *Black Atlantic.* This approach produces a very different viropolitics of frequency in contrast to that implemented by sonic branding. Whereas sonic branding seeks to induce consumption by channeling sound's power into the modulation of affective tonality in order to forge associations with real or virtual products, Black Atlantic futurism seeks to enact the demise of Babylon through dread engineering and the tactical deployment of sonic dominance. The contagious vibrations, sonic processes, and market tactics of strains of popular music within the African diaspora both extend the concept of an audio virology and offer a tactical outline of an affective *mobilization* as opposed to the *modulation* of preemptive capital. A virology of the Black Atlantic runs on the notion that diaspora has an epidemiological etymology.[1] The term *diaspora* comes from Greek and Indo European origins and refers to a rhythmically distributed, mobile population, spread out, scattered. In its audio virological mode, the Black Atlantic is therefore rewritten as a network of labs,

incubator populations, transmission media, host bodies, immune systems, rates of propagation, and degrees of infection and mutation.

Such virologies, Kodwo Eshun tells us, can be found in the sonic fictions permeating electronic music, especially those that share a postapocalyptic cyberpunk worldview of digital capitalism.[2] One of the most vivid instances of an Afrofuturist fiction of virological sonic warfare explored by Eshun is from second wave Detroit techno outfit Underground Resistance (UR). UR has one of the most explicit hyperstitional systems outlining an evolution of rhythmic genetic strains in which colonialism is recast in a sweeping history of population conflict of cosmic proportions. The sleeve notes to its *Interstellar Fugitives* album develop a kind of sonic virology in a fictional report issued by the Intergalactic Bureau of Investigation. The city of Detroit becomes a vast rhythm-machine, with mechanically pulsed affective waves rippling intensity across the urban skin, carrying sonic parasites to hijack your nervous system. The sonic warriors are carriers of a potent R1 mutant gene and are referred to as "digital Ebola guerrilla operatives with reinforced rhythm awareness capabilities."[3] Activation of the potential of the mutant strain results in the affective mobilization of populations in dance. The R1 strain is diagnosed as "older than humanity itself and was sequenced into human genetics by probabilities still unknown. R1 communicates through secret coded rhythm patterns based around the drum that is common in all human societies. It should be noted that these rhythms can also be vocalized, expressed through dance or art, and transferred by rhythmically oriented machinery." In this sonic fiction, control becomes a immunology. The report continues describing a dangerous mutation: in a "constant search for ways to combat the ever increasing evil of the systems programmers, R1 has most recently employed a little known frightening bio engineered mutant cousin gene that was created during a period of time ranging from the 1400s to the late 1800s in colonized areas throughout the world and especially in the new world of the Americas. The cousin which we will call z (for zero) to signify its complete erasure from history was the result of illicit genetic breeding experiments performed on enslaved human stock of the R1 gene." This z model was elusive, "chameleon like, unpredictable and final (see the maroons) and although it could deceptively function within any given society it would only take true directions from R1 using its enhanced rhythm perception it could decipher R1 directives from anything ranging from a field work song to the rhythmic flow of a poets lines to automated modern machinery." Combining a revisionist black history with science fiction, genetic theory, and ethnomusicology, UR produced

a kind of "dub fiction," where history is versioned into an occulted vibrational battle of cosmic proportions that parallel Ishmael Reed's *Mumbo Jumbo.*

Aside from sonic fictions such as these that come packaged with the music itself on sleeve notes, track titles, artwork, and so on, theorists such as Frank Gunderson have attempted to force direct engagement between the cultural virologies developed within memetics to the musics of the African diaspora. For Gunderson, memetic theory would propose "that some rhythms, for whatever *groovilogical* reasons, are catchier than others, are more quickly received than others. Crowds tend to gather whenever they are played, thus insuring their infectious spread to more bodies."[4] Certain modes of rhythmic configuration can therefore function as an attractor in processes of group catalysis. Indirectly, he investigates the "changing same," Leroi Jones' term for the orientation to future history of the Black Atlantic in terms of riff dynamics:

> By "riff" I mean the short repeated segments of sound known as ostinatos in musicological terms, which are deployed singularly or in overlapped layers in drum parts, in melody fragments, as accompaniment, and as bass lines. The riff is crucial in supporting improvisation and call and response exchanges, and once employed as a groove, it is the musical unit that most compels the body to move. The riff is the most tenacious of African American music memes, the definitive competitive musical virus. Ultimately, it is the riff meme that constitutes the basic unit of African American musical tradition, not any one corpus or genre or tradition where repetition was the major factor.[5]

Gunderson, by plugging memetics into a history of hyperrhythmic contagion, potentially moves beyond its limited informational model. The "earworm as riff" is suddenly ascribed so much more power—not merely the power to be remembered and transmitted via imitation, but more profoundly the power to move the body in dance through affective mobilization. Rhythmic contagion seems to stretch memetics beyond its limits. Rhythmic contagion is submemetic in the sense that the unit of the meme is turned inside out to reveal its ontogenetic relations, what produces it as individuated block of affects or a nexus of microevents. During the violent "evolutionary climate" of diasporization, that is, the forced migration of the middle passage, riff transmission occurred "under duress": "In order to survive, music transmission needed to be effective, catchy, as well as a quick study." In this context, Gunderson describes James Brown as a "replicator vessel" with an "affinity for collecting and transforming riff and groove memes, operating in a milieu where he creatively put together the most essential materials from the existing music meme pool. In James Brown's own words: 'I mapped the music's DNA—cracked its code and found grooves.'"[6]

In the propaganda of Black Atlantic futurism, typified in concentrated form in sonic fictions such as UR's, these riff patterns constitute virtual parasites or affective weapons, encrypted rhythms of a nonconscious bionumeracy, a synesthetic pulse pattern. Rhythm becomes a logistical delivery apparatus, a conveyor belt of multiple species of earworm. In the sonic fictions related by Eshun, molecular cultural warfare often figures prominently while the dub methodology of track/cut/version incubates audio viruses, rhythmic guerrilla genetics, dub zombies, and bugged-out clones. Crucially, unlike the transcendence of science and its immunity in the memetics of Richard Dawkins, for Eshun, these kinds of sonic science (fiction) not only discuss cultural viruses; they are themselves "a viral contagion."[7]

In addition to UR, one of the most intriguing articulations of this audio virology of Black Atlantian contagious rhythmatics appears in Ishmael Reed's *Mumbo Jumbo,* where the central protagonist is the *jes grew* virus, or what Reed calls an *antiplague.* This antiplague, for Reed, takes its name from the proliferation of ragtime songs in the early twentieth century that "jes grew," or just grew. Jes grew is a particularly interesting cultural contagion because it cures its victims of the rhythmically retarded influence of Eurometric musical civilization. In a sense, jes grew is a very Spinozist virus: its conjunction with a body serves to increase its power to affect. In Reed's text, it functions as a weapon in a battle extended to cosmic proportions, ultimately entailing a contest between carriers of jes grew and the atonists, supporters of the mythology of Western civilization, a clash between black and white magic. Reed's deployment of the jes grew virus also clarifies what is at stake in the divergent temporalities of futurism versus that of Afrofuturism. Instead of leaving the past behind or treating it as static, Afrofuturist sonic fictions tend to find routes to the future in the past through the looped achronology of time anomalies or the "knockings," communiqués from outside the present, transmitted like radio waves in terms of premonitions or memories of the future.

The Black Atlantic provides many other prototypes of virosonic war machines, or what, in *More Brilliant Than the Sun* Kodwo Eshun terms *tactics* in the "redesign of sonic reality." A particularly key manifestation of audio virological pragmatism has developed around the sonic diaspora of Jamaican pop music. In "Ghostlines: Migrations, Morphology, Mutations," Eshun and Edward George, a former member of the Black Audio Film Collective, map out a time line of the infection of European popular music culture by reggae, dub, and dancehall.[8] Elsewhere Steve Barrow wrote that "dub . . . is the virus infecting and mutating

such musical styles as Jungle, House, Techno, Ambient and more."[9] The "dub virus" relates not just to the direct influence of the dub reggae sound on other musics, but more than this, its catalysis of an abstract sound machine revolving around the studio as instrument and the migration of a number of production and playback processes. The dub virus hacked the operating system of sonic reality and imploded it into a remixological field. The dub virus, taken in these terms, is a recipe for unraveling and recombining musical codes.[10] In 1995 Kevin Martin (aka the Bug) compiled a series of compilations entitled *Macro Dub Infection* complete with an achronology of the evolution of the dub virus (origin unknown) as it reassembled popular music from below: an "amoral corruption" affecting "all musical forms it digests."[11] As one Jamaican sound system vocalist, Prezident Brown, put it in the track "Roots in the Music," "Reggae music is like a disease that is incurable / Once you catch it you have it for life / We spreading the virus till the whole world get infected."[12] One writer quotes another reference to the virulence of this acoustic infection, which was known to be "very contagious and believed to be airborne."[13]

For Mark Fisher, this dub virus is expressed through the propagation of an abstract process he terms *dubtraction:*

> The hyperdub practice par excellence, and its abstract sorcery (and sorcery of abstraction) connects Lee Perry to Nico Sykes, Brian Wilson to Can. Fundamentally, dubtraction is about the production of virtualities, implied songs all the sweeter for their lack of solid presence. It's all about what is left out, an involutive process that identifies desire with the occupation of a plateau. Hints, suggestions and feints: these complications of desire function not as teases but as positive deviations from both climax and monotonous idling on the spot. Dubtraction understands that desire is about neither engorgement nor emaciation, but about getting the right amount you need in order to keep moving.[14]

The sonic manipulations central to the process of dub versioning deploy electronic effects such as echo, delay, and reverb as means to sonic seduction. All can, in the production of these virtualities, generate effects that simulate the physics of sound within a certain acoustic space, particularly the reflection of sonic vibrations off surfaces, for example, the walls that demarcate that space. The delay time within a physical space is dictated by the size of the room—the time the sound takes to bounce back. The sound that bounces back can be heard as a delayed and decayed version of the original sound. However, the conceptual power of such effects is in their potential to preempt virtual sonic spaces that do not yet actually exist, populating real spaces with audio hallucinations.

Moreover, they hack into sonic objects, catalyzing mutations into monstrous, uncontrollable morphologies. In sonic processes such as delay, a tendency to tip over as the intensity of the source resonates with reflected vibrations can result in an escalative, positive feedback spiral. A sonic entity can suddenly flip over into a field of sound. In summary, dub virology, via its armory of sound effects and its generalized logic of the version, produced a contagious diagram that has served as one of the dominant operating systems of electronic music culture since the early 1970s.

More than this, some critics, such as Ian Penman, argued that the route through Jamaican dub produced an alternative, diasporic orientation to the condition of ubiquitous music outlined by Kassabian. He notes that instead of being produced as a universal music, "dub has taken an opposite route to these other examples—muzak, elevator, exotica, soundtracks—which were already everywhere and untheorised, and then drawn into the specialist enclave of theory. Dub has followed the opposite trajectory: an arcane moment, a strange isolated example which has SPREAD OUT to infect inflect a certain Everywhere. . . . So that it has found its 'reste'—its cyber Zion, its circulation, its afterlife: its Apocalypse—in the unlikeliest places. From the background to an apocalypse of very local perplexities, it has become this everywhere soundtrack."[15] Penman's particular variety of dub virology represents the idea of dub as deconstruction.[16] But it also questions the application of cultural theory to music, instead positing the way in which dub contains its own, immanent theory engine. It produces a sonic philosophy that scrambles the separation between theory and its musical objects of study. In this way, it still stands as one of the strongest examples of Eshun's suggestion that electronic music has no need to be rescued or theorized by a transcendent cultural theory but is instead already immanently conceptual.

Like Reed's jes grew, the dub virus, for Penman, operates on the extended timescale of a postcolonial clash of civilizations, in which the ghosts of slavery and forced migration return to haunt the European spirit. The colonized of the empire strike back in stealth mode through virosonic infiltration. Here the dub virus travels in the waves of babel that threaten to bring down the tower. The resort to audio virology is an attempt to answer a particular question: "How did it happen that—against all the teleological odds—dub became omnipresent? How did [Marcus] Garvey's ghost come to reign in the European geist, in the secret recesses of Heidegger's heimat? . . . How did something so local and specific as Jamaican dub become so generally accessible and amenable to quotation?"[17] In part, the answer to this question is what Manuel and Marshall term the "riddim

method."[18] In the late 1970s and early 1980s, as roots reggae was ousted by dancehall as the dominant popular music in Jamaica, the dub virus's sonic processes underwent a digital mutation. A key event within this hyperactive sonic ecology was the Sleng Teng 'riddim' (patois for instrumental rhythm track), which marked the threshold of digitalization in Jamaican dancehall culture. Wayne Smith's "Under Me Sleng Teng," produced in 1984, was the first fully computerized rhythm to properly blow up in Jamaica and was created on a Casio music box.[19] It was based on a riff from Eddie Cochran's tune "Something Else" but was slowed down and rebuilt by Jammy's engineer, Tony Asher. The riddim was famously unleashed on the world at the historic sound clash between Jammy's and Black Scorpio at Waltham Park Road in Kingston on February 23, 1985. Smith's only number one song was produced at Lloyd "King Jammy's" James studio. It reportedly spawned over a hundred recordings on the beat (including singer Tenor Saw's breakthrough hit "Pumpkin Belly") and continues to be sampled or covered today. Coupled to dubtraction, digital dancehall's rhythm culture illustrates that the "riddim method" is also driven by "riff replication and mutation."

As if acknowledging the musical virulence of Jamaican pop, the most popular dancehall riddim of 2001 was called the Virus riddim, a Madd Dawg version of an old Duke Reid track. Like many of the other dominant riddims of the day, this was released not just on a series of singles featuring different vocals but also on the *Greensleeves Rhythm Album* series of double compilations. Like a thermometer of the intensity of this viral musical culture in tough economic times, rhythm albums mirror one of dancehall's primary protocols. This process constitutes a kind of "riddim optimization." Anyone familiar with the impact of 909 kick drum on the evolution of techno, the Apache break on the emergence of hip-hop, or the Amen funk break on the emergence of jungle will understand the viral logic.[20] What the riddim album captures is the startling efficiency of breeding whole sonic microcultures out of one core loop, a refrain to be populated by up to thirty different vocal cuts. The story of a riddim's rise and fall, of the trade in seven-inch vinyl, is also a tale of the intricate dynamics of hype, of playing a volatile market in which styles and fashions "buss big" one month and are "a dead stock" the next. It is this incredible speed of change that singles out the Jamaican music industry as one of the most hyperactive in the world.

Dancehall's "riddimania," evident in the rhythm albums, continues and mutates the logic of the "version," developed in Jamaican dub in the late 1960s and early 1970s. Versioning defines what dub does to the reggae vocal track. It essentially remixes the original, using an array of effects, usually morphing the

song into a series of ghosted vocal traces haunting the rhythm track that has been stripped down to a functional minimum of bass, drum, and effects. From the 1980s onward, "versioning" undergoes an intensification because of the logic of digital replication, transforming the dub virus, in Britain particularly, into a "hyperdub virus," which extends the dub virology into the realm of the "hardcore continuum,"[21] particularly the lineage of underground musics that stretches from hardcore, jungle, drum'n'bass, U.K. garage, grime, dubstep to more recent U.K. variants of house such as bassline and funky.

In short, the virologies of the Black Atlantic, from the riddim method of Jamaican pop, to the sampladelia of U.S. hip-hop, the remixology of disco, house, and techno, and the hyperdub methodologies of the hard-core continuum, constitute a wealth of techniques for affective mobilization in dance. Parasitic on the innovations of such popular musics, virosonic capital hijacks these techniques of affective mobilization and converts them into a control program for modulation. It is this ever-decreasing gap between mobilization and modulation that is the core focus of an audio virology.

30 1928: Contagious Orality

While Afrofuturist sonic fictions and processes such as dub virology focused on the armory of effects (particularly reverb, delay, and subtraction) whose techniques of abstraction facilitated a proliferation and generation of a kind of "dub diaspora," it has been argued that such preoccupations neglect the role of more traditional weapons of sonic warfare within postslavery black music, especially the voice. Spirituals, for example, were deployed as sonic weapons by both black and white abolitionists in the struggle against American slavery. The protest and yearning expressed in song or the rhythmically spoken word, from gospel, to soul, to roots reggae, to hip-hop and R&B, continued this mobilization of the voice. It is against this background that some writers have, from a more humanist stance, criticized Afrofuturism, raising the question of the vocal material on which its armory of sonic processes is effected. Two pertinent examples of these critiques of Afrofuturism can be located. They target both its dub virologies and its affinity, in its most compelling strains, to an alien inhumanism.

The first, fired from what is essentially a traditional cultural studies perspective, concerns the political semiotic content of the transmitted voice within, for example, reggae, and the potentially deracinating effect of musical deterritorialization. In a polemical article entitled "Back to the Roots," music critic Simon Reynolds noted how the virologists of sound seemed to gravitate around instrumental electronic musics (from dub to techno to glitch), revealing as much by what they left out of their poststructuralist musings as what they included.[1] Reynolds accuses "the cluster of ideas [that] can be described as the

Afro-futurist discourse, but it actually has multiple facets: dub as deconstruction (of the song, of the metaphysics of musical presence); the producer as mad scientist, dark magus, shaman, trickster; the 'Macro Dub Infection' notions of dub as post-geographical virus and of dub's sonic instability as an education in 'insecurity.'"[2] He complains that what all these dub virologies shared was ironically the "exaltation of producers and engineers over singers and players, and the idea that studio effects and processing are more crucial than the original vocal or instrumental performances. . . . The really distorting side effect of the Afro-futurist privileging of the producer, though, is the fact that reggae actually involved people saying stuff about stuff has almost totally been forgotten."[3]

For Reynolds, by focusing on the dub virus as a set of abstract processes that have migrated across the Jamaican sonic diaspora to infect and mutate music from elsewhere, the sonic material that dub deconstructs through its sonic processes, that is, the human voices and their politico-semiotic content relating to everyday social, political, and religious concerns, were being ignored. Reynolds specifically is referring to an alleged failure of dub virologists, for example, David Toop and Kodwo Eshun, to give due discussion to the content of Black Atlantian oral culture in their writing.[4] Yet while Reynolds is certainly correct to attempt to rechannel some critical attention to the voice, the representational dimensions of black popular culture generally, and Jamaican music specifically, are hardly lacking in the discourses surrounding these themes. If anything, the dub virologists operated in precisely the blind spot of such discourses, adding a techno-affective dimension to compensate for the clichés and moralism that Eshun attacks in the introduction to *More Brilliant Than the Sun.* An audio virology would therefore have to tread carefully in its formulation of contagious oral cultures—careful not to lapse back into those models that subordinated the sonic dimension of the word at the altar of its written face in order to break speech's aura of authenticity and presence. Contagious orality must therefore be placed within the rhythmic and vibrational infrastructure of the plane of machinic enunciation. To extend an audio virology in these directions would involve a discussion of the virological traits of those phonemic populations that we know as speech, song, and their evolutionary linguistic ecosystems, technical decompositions, and recompositions. Reynolds's comments notwithstanding, the dub virologists helped open up this key dimension of machinic orality in the understanding of black music.

A second and related critique was aimed not so much at dub virologies directly but what, for Eshun, certainly accompanied this, that is, a dystopian ear

for the alien and the machinic. In many ways, Reynolds's criticisms of Afrofuturist dub virology run parallel to those made by Alexander Weheliye in his own discussion of the cultural politics of the interface of black music and technology. In a sense, Weheliye attempts to "humanize" aspects of Eshun's *More Brilliant Than the Sun*.[5] Building on what was already implicit in Eshun's work, that is, a theorization of the synthetic voice, and drawing from more recent discussions of African American and Black British popular music, including those of Reynolds, Weheliye begins to flesh out the contagious orality he claims is missing from Afrofuturist theory. In essence, the concept of "hypersoul" is added to "hyperdub."

Weheliye's writings on Afrofuturism are skeptical. In his book *Phonographies: Grooves in Afrosonic Modernity* and an earlier essay, "Feenin: The Post-Human Voice in Contemporary Black Popular Music," he argues that the vocoder poses a specific problem for Afrofuturist theorizations of black musical technoculture.[6] For media theorist Kittler, the vocoder is another example in the inventory of military technology mutating popular culture. In *Gramophone, Film, Typewriter,* he notes, ignoring Homer Dudley's late 1920s research into the Voder, that the vocoder was first implemented between 1942 and 1945 by Claude Shannon at Bell laboratories and Alan Turing in the British Secret Service. It was, Kittler proclaims, "a wonder weapon which was to make the transatlantic conversation between Churchill and Roosevelt safe from interception by Canaris and the German Abwehr, and which like so many electronic achievements of the Second World War, is now indispensable to popular music."[7] Taking the envelope of one signal (formant), for example, a voice, and transposing it onto another (carrier), for example, a synthesizer, "one acoustics controls the other":

> In order to test his vocoder, by the way, Turing first played a record of Winston Churchill's belligerent voice, whose discreet or cut-up sampled values he then mixed with a noise generator using modular addition. Whereupon British officers heard the voice of their prime minister and commander-in-chief contaminate the speakers as just so much white noise [not to say, primal sound]. Appropriately, Turing's vocoder was named after Delila, who in the Book of Judges tricked another warrior, the Danaite Samson, out of the secret of his strength. Turing's skill as a tinkerer, however, revealed the secret of modern political discourse to be something far worse than weakness: "a perfectly even and uninformative hiss" which offered no regularities and, therefore, nothing intelligible to the ears of British officers or those of German eavesdroppers. And yet, sent through the vocoder a second time, Churchill's original voice emerged from the receiving end.[8]

The vocoder is therefore another reminder of where popular entertainment media technologies productively "abuse" the technologies of war. This is the

upside to the militarization of everyday life. Alongside mechanical and magnetic recording, radio transmission and now digital sampling, time stretching, and automated tuning, the vocoder afforded another schizophonic mutation of the voice that intensified its contagiousness, helping generate a new kind of infectious orality that would prove inspirational to German Electronische Musik and catalyze a vector that runs from Wendy Carlos, through Kraftwerk, Laurie Anderson, Herbie Hancock, Africa Baambatta, Zapp, right up to Tupac and beyond. In fact, in the hands of Afrofuturist musics, the vocoder became a means for upgrading one of the few possessions transportable during forced migration: oral culture. The vocoder synthesizes the voices of the wandering ghosts made homeless at the origins of modernity.

Weheliye's intervention is two-pronged, with one spike aimed at the (white) posthumanism of cyberculture theorists such as N. Katherine Hayles and the other at the (black) futurism of Eshun. Weheliye argues, contra Hayles, that we can understand the synthesis of the human voice with intelligent machines without assuming that "information lost its body." Contra Eshun, he claims that neither is it necessary for a black posthumanism to take on alien form.[9] For Weheliye, through examining the vocoder within the context particularly of African American R&B music, a different form of posthumanism is produced, "not mired in the residual effects of white liberal subjectivity." And this, he claims, makes possible a model of "subjectivity located in the sonic arena rather than the ocular."[10]

In reality, Weheliye's discussion of "hypersoul" via the vocoder effect is much more compelling than his arguments against either Hayles or Eshun. He builds on Eshun's observation that "soul" and the "postsoul" tendencies are present in all-black popular music as divergent pressures toward the organic and inorganic, respectively. The vocoder effects and its synthetic voice and antinaturalistic desiring machines form a powerful example precisely because of its virulence within what is otherwise renowned as an overwhelmingly humanist genre of "soul" music.[11] But of particular interest here is Weheliye's critical engagement with Afrofuturism.

Eshun's strain of posthumanism intensifies cultural cybernetics with the recognition that New World black subjects had been persistently excluded from the category of the human. He constructs Afrofuturist lineages within the fringes of black pop, avant-garde, and electronic music that seceded from the human so as to imagine and pursue, in terms of fiction or a sonic machinism, or both, other

modes of thought, experience, and collectivity. He maintains, in a passage also quoted by Weheliye, that

> the idea of slavery as an alien abduction means that we've all been living in an alien-nation since the eighteenth century. The mutation of African male and female slaves in the eighteenth century into what became negro, and into an entire series of humans that were designed in America. That whole process, the key behind it all is that in America none of these humans were designated human. It's in the music that you get this sense that most African-Americans owe nothing to the status of the human. There is this sense of the human as being a really pointless and treacherous category.[12]

Eshun therefore pursues those sonic fictions that positivize the identification of Black Atlantians with objects and machines alluding, of course, to the original meaning of the robot in Czech as slave. But for Weheliye, Eshun is merely inverting a binary opposition installed by colonialism itself. In this sense, he argues, against Eshun, that it "is precisely because slavery rendered the category of the human suspect that the reputedly humanist post-slavery black cultural productions cannot and do not attribute the same meaning to humanity as white American discourses."[13] Weheliye indicts Eshun for not taking into account the contagion of Afrofuturism on genres considered to lie within the soul tradition. Weheliye, like Reynolds, argues that emphasizing the inhumanism of Afrofuturism encourages a tendency to focus on its instrumental musical currents at the expense of the black voice. The vocoder adds a contagious, machinic orality to the abstract sonic effects and robot rhythms of the "postsoul" tendency of black music identified by Eshun.

Weheliye traces the shift from the vocoder to the vocoder effect, from the focus on an analog technology to a digital one. The vocoder effect is Weheliye's key example of the failure of Eshun to consider the way Afrofuturism would infect genres of black popular music (R&B) that were not self-consciously technology focused (techno). He analyzes the vocoder effect within R&B to show how a disjunction between form and content occurs. He notes that the content of certain R&B lyrics, while processed by the vocoder effect, do not reflect the technological machines that filter them, so much as the machines of desire, thereby mutating soul into hypersoul music.

Eshun argues that all black music contains two divergent tendencies, which he terms the "soulful" and the "post-soul." In *More Brilliant Than the Sun,* he is obviously most interested in how these tendencies were playing out in Black Atlantic at the end of the twentieth century, particularly as represented by a

“humanist R&B” and a “posthuman techno,” but he does note that he is also concerned with the mutant symbioses of these two tendencies.[14] It somewhat misses the point, therefore, to argue that Eshun does not give enough attention to the (technologically mediated) voice, especially since he emphasizes time and again that his main object of analysis is the futurhythmachine. In a later essay in which he addresses turn-of-the-century R&B, he is consistent in following his more rhythmanalytic concerns developed in his earlier work to look at the hyperkinetic audiovisual syncopations of Hype Williams’s video work and how they were infected by the stutter-funk of Timbaland and Missy Elliot.[15] Again, as with the case of Reynolds’s critique of dub virology, it is hardly the case that the majority of discourse surrounding the history of black popular music pays no attention to the human voice and what it refers to. In fact, it rarely does anything but this.

The main problem of Weheliye’s critique, unfortunately typical of academic posturing, is that he criticizes Hayles and Eshun for not doing something that neither of them set out to do in the first place, by implication rhetorically weakening the power of his more important argument regarding the need to make issues of race more central to cybertheory. In addition to continuously conflating concepts of the machinic with mechanistic, a key drawback of Weheliye’s critique of Eshun is that it partly suffers from the advantage of retrospective arrogance. Actually it was only the late 1990s innovations in U.S. R&B and their influence on U.K. garage that occurred after the publication of *More Brilliant Than the Sun* that consolidated the conception of “hypersoul” which Weheliye deploys against Eshun’s earlier version of Afrofuturism.

Both Weheliye and Reynolds are making similar arguments against Afrofuturism from the point of view of a humanist critique of posthumanism and recent developments in popular electronic music. Of course, if these arguments were merely terminological disputes, of discursive inversions, redefinitions, and interpretations, then maybe the issue could be left there. Despite the social constructionist methods of much techno theory and those who critique its ideology, cybernetics is much more than a set of discursive formations, but operates at the level of the construction of reality itself, not just its representations.

Weheliye’s analysis stays somewhat limited by its confinement to the discursive formations and the social constructions of the human. While circling around a rhetoric of embodiment, he merely discusses texts with little attention to the body, its resonant frequencies and technological conjunctions. It is the material transformations of cybernetic culture and its mutation of what a body

can do that renders the category of the human problematic, more than just a question of discursive formations. The "meaning attributed to humanity" that Weheliye is concerned with just points to the tip of the iceberg. Eshun's more general reason for pursuing an alliance with the inhuman, as clarified in his "Further Considerations" essay, goes beyond his postcolonial antihumanism.[16]

Eshun's materialism is evident, for example, in his critique of Richard Dawkins's version of memetics that stops short of complete immanence, excluding himself and science from his cultural virology. Eshun's work deserves a much more serious treatment than an identitarian cultural studies, even in its more synthetic variants, makes possible. Contra Reynolds and Weheliye, the Black Atlantian futurism as specifically described by Eshun stands as a conceptual event whose reverberations for a theory of sonic warfare should be welcomed, not responded to defensively.

On a more constructive note, even Weheliye himself notes that while "singers remain central to the creation of black music, they do so only in conjunction with the overall sonic architecture,"[17] a sonic architecture, which for Reynolds, can be addressed only through an approach to the "sound of politics" developed in the 1970s, coupled with the 1990s orientation to the "politics of sound."[18] It is clear from the preceding discussions of the voice and the limits of dub virologies that an audio virology is a call for an ecological remit. What is meant here is that its map would begin from an inventory of the frequencies, bodies, feelings, machines, utterances, emissions, codes, processes, affordances, economies, and environments involved in any sonic nexus. Such an affective ecology is not opposed to the representational concerns that Reynolds poses, but rather comprises the very environment out of which politicolinguistic assemblages in popular music are generated. Instead, it is more accurate to maintain that the processes of dubtraction, the schizophonic psychic effects in both producers and listeners, the sorcery of sonic processes, and the contagious deterritorialization of Afrofuturism's dub virology are not opposed to "people saying stuff about stuff." Rather, if the power of Jamaican sonic processes is to be recognized in their profound influence on Western musical culture, then this is as much about the contagious machines of thought emitted by a dub virology as the politicized content of its lyricists. Either way, this detour through Afrofuturism and the politics of black music illustrates the tactical importance of rhythmic and vibrational processes in producing conditions for affective mobilization.

2020: Planet of Drums

31

> The person cringes with each large beat, as if the drum mallet descended upon his very skull; he ricochets about the peristyle, clutching blindly at the arms which are extended to support him, pirouettes wildly on one leg, recaptures balance for a brief moment, only to he hurtled forward again by another great blow of the drum. The drummer, apparently impervious to the embattled anguish of the person, persists relentlessly; until, suddenly, the violence ceases, the head of the person lifts, and one recognizes the strangely abstracted eyes of a being who seems to see beyond whatever he looks at, as if into or from another world.
>
> —Maya Deren, "Drums and Dance" (1976)

Since at least the blues, much of the most urgent, modern music on the planet has emerged from the bruised and bleeding edges of depressed urbanism. Contemporary configurations of rundown global urbanism are described in Mike Davis's prophetically grim recent text, *Planet of Slums*.[1] Yet it is necessary to complement *Planet of Slums* with a cartography of the *planet of drums* (or rather drum machines.) At the close of his *The Ecology of Fear,* Davis zooms out to a satellite orbiting Earth. The satellite is producing thermal images of the United States. During the Los Angeles riots of 1992, he remarked, the city ablaze would have been perceived as a "unitary geophysical phenomenon." "No other urban area on the planet so frequently produces "large thermal anomalies." Seen from space, the city that once hallucinated itself as an endless future without natural limits or social constraints now dazzles observers with the eerie beauty of an erupting volcano."[2] Imagine for a second a parallel satellite monitoring

low-frequency vibration, not just the seismic activity of tectonic plates, the boom of heavy industry and traffic, but also the pulsing bass cultures of the sound system diaspora of the Black Atlantic. It is this imaginary map of vibration that will be charted here, adding the dimension of aesthetic and cultural tactics to offset, perhaps just a tiny bit, Davis's all-encompassing dystopic characterization.

So what sonic cultures are incubated within the emergent urbanism of the *Planet of Slums,* and what tactics of frequency do they deploy? What affective mutations of the urban environment are activated where slum, ghetto, shantytown, favela, project, and housing estate rub up against hypercapital? By constructing vibratory ecologies and pirate economics, otherwise predatory locales subject to significantly unequal development are temporarily taken over. While liberals lament the politically incorrect vocal content of planetary mutations of hip-hop and Jamaican dancehall, these bass cultures press on with Fela Kuti's declaration that music is still "a weapon of the future." Perhaps, however, it is mostly a weapon at a subpolitical level. In both white and black musical traditions of the twentieth century, the politics of music has often been reduced to "what is said": its content, meaning, the narrative superimposed on top of its form, or the extent to which it was supposed to represent an exterior political reality. But a more basic power of organized vibration is usually overlooked. This subpolitical power of music to attract and congeal populations, within the examples that follow, will be tagged *bass materialism.* Bass materialism, it will be argued, is enacted as the microrhythmic production and occupation of space-times by collectively engineered vibration.

In *Planet of Slums,* the topology of unequal development noted by world systems theory is extended. Core and periphery are tightly enfolded. Islands of the hypercapitalist core rise up, fortressed within developing regions of the world, while basins of periphery encircle the core of the developed world. Davis's book argues that rather than the high-tech city of cybernetic control, we should be looking elsewhere to gauge the future shape of cities. As opposed to the finely tuned, preemptive modulation of hypercontrol in the core, there coexists a peripheral urbanism of an unprecedented scale and density, often characterized by predatory locales in which fear is ingrained into everyday life due to underdevelopment, a deregulated economy of violence, drug wars, gang factionalism, and abject poverty. Davis's depictions are particularly bleak not just because of their realism, but also because they ignore some of the cultural pragmatics that make existence bearable.

So it is useful to force Davis's dystopic urbanism into confrontation with the modus operandi of pirate media and sound system cultures in the neighborhoods of underdeveloped cities. In otherwise hopeless situations, collective excitement is produced and local youth cultures activated in kick-starting microeconomies. Despite representing a multiplicity of socioeconomic configurations, ethnic specificities, colonial legacies, and complex musical histories, there are some commonalities to be found in the sound system pragmatics and pirate economics of many of these synthetic music cultures of the periphery: their construction of temporary bass ecologies to hijack through sonic dominance—a rhythmachinic takeover of space-time. How do these sonic war machines, through pirate economics and affective mobilization, transduce, even temporarily, pervasive fear and exorcise dread into momentary joy through the ritualization of aggression in collective dance?

In *Planet of Slums,* Davis outlines how the demographics of urbanization on twenty-first-century earth are in terminal transition. The digital flashfloods of viral economics are paralleled by the massive exchanges of migrant populations, highlighting the frayed edges of McLuhan's global nervous system as it undergoes cellular decomposition, molecular mutation, and trade in sonic fluids. The key agents in the emergent global configuration are the "new megacities with populations in excess of 8 million, and, even more spectacularly, hypercities with more than 20 million inhabitants,"[3] as the result of massive unilateral rural-to-urban migration. For the first time in the evolutionary history of the human species "cities will account for all future world population growth, which is expected to peak at about 10 billion in 2050."[4] As Davis's rival, H. de Soto, notes in *The Mystery of Capital,* radio has functioned as a magnet in this process, advertising the opportunities of urban living across the rural world.[5] Radio, McLuhan's "tribal drum,"[6] acts as a mobilizing call to urban replication. *The Planet of Slums,* for Davis, is composed of "interchangeable and spontaneously unique" components, "including the bustees of Kolkata, the chawls and zopadpattis of Mumbai, the katchi abadis of Karachi, the kampungs of Jakarta, the iskwaters of Manila, the shammasas of Khartoum, the umjondolos of Durban, the intra-murios of Rabat, the bidonvilles of Abidjan, the baladis of Cairo, the gecekondus of Ankara, the conventillos of Quito, the favelas of Brazil, the villas miseria of Buenos Aires, and the colonias populares of Mexico City."[7]

The sonic anarchitecture of these emergent urban entities has usefully been tagged by music blogger Woebot (Matt Ingram) as "shanty house theory," referring to the coincident music network that has arisen out of these planetary

locales, from the grimy pirate radio stations of East London, Crunk from the southern United States, dancehall from Jamaica, baile funk from the Brazilian favelas,[8] kwaito from South Africa, reggaeton from Puerto Rico, and others. For Ingram,

> Shanty House is the new strain of post World Music engaging in the same cultural and social dynamics that have given us Crunk and Grime in the first world and Dancehall in JA. Detractors might bemoan the need to give Favela Funk, Kwaito and Desi a brand name. However, like it or lump it these forms are always going to exist on the peripheries of most people in the west's experience of music. If they aren't called something specific then they'll be less absorbable in their own right, and conversely will be viewed as an extension of World music. The concept of "World Music" is inextricably intertwined with concepts of the natural, the earthen, and the rooted. However, the new wave of global urban music is mercilessly hooligan in its agenda, synthetic by choice and necessity, often produced in a crucible of urban existence yet more extreme, precarious and violent than that which characterizes the temperature of New York, London, Berlin.[9]

In a somewhat condemning article in the *Village Voice* on M.I.A, the artist whose work masquerades as a "conference all" between these degenerate locales of the *Planet of Slums,* Simon Reynolds elucidated the condition of shanty house theory as

> world-is-a-ghetto musics: impurist genres . . . that typically suture bastardized vestiges of indigenous folk forms to pirated elements of rap, rave, and bass 'n' booty. Locally rooted but plugged into the global media sphere, these scenes don't bother overmuch with sample clearances, and vibe-wise they typically project ruffneck raucousness leavened with party-up calls to shake dat ass. They also speak, vividly if obliquely, of a new world disorder where Tupac Shakur vies with Bin Laden as a T-shirt icon and terrorists keep in touch via text messaging.[10]

A more literal description was offered by blogger, ethnomusicologist and DJ Wayne Marshall, who labeled the web woven by those DJs like himself who connect these disparate music cultures as "global ghettotech."[11]

From Brazil, the strain of these mutant musics that has attracted most attention overseas is known as baile funk or favela funk. Typically deploying huge do-it-yourself sound systems at a party, the "walls shake, the concrete under our feet rumbles and below, on the dance floor, some 2,000 dancers gyrate beneath a powerful strobe."[12] The DIY ethic extends beyond just the soundsystem to define the aesthetic of the music, splicing Miami Bass with any music whatsoever pillaged from film soundtracks and America pop. "People make funk like they build houses in the favela, using whatever material is available."[13] It would be naive to pretend that there is a necessarily politically progressive agenda behind

the organization of baile funk parties. As Neate and Platt point out, "It's often the drug factions that promote and finance the baile. Their motivations are twofold: first, the parties are popular within the communities, thus securing their power base; second, they draw customers for the drug trade into the favela."[14] Yet funk is also a mass musical movement. An interesting contrast is possible with Rio de Janeiro's Afroreggae movement, which, with a more explicit political agenda, has attempted to bridge gang divisions within favela residents, especially young men, via drum workshops and other techniques of musical mobilization.[15] One question illuminated in this contrast, a question common in grassroots musical movements around the planet, is whether aesthetics need be sacrificed at the altar of a political cause.

So is this a *planet of drums* to accompany Davis's Planet of Slums? What makes these Afro-diasporic music cultures key here, aside from their content as music, is that they generate bass ecologies within underdeveloped zones of megalopian systems. As such, they have cultivated, with Jamaican sound system culture as the prototype or abstract machine, a diagram of affective mobilization with bass materialist foundation. Taking the staples of popular electronic music, from hip-hop to house and techno, and mutating them to their local desires, spraying them with local voices, these musics also, hand in hand with their pirate economics, propose models for affective collectivity without any necessary political agenda. Parallel sonic wars (in the age of pirate replication) are being waged across the planet by an array of these virosonic microcultures. Their abstract machines are never purely sonic. They always possess a power of transversal application into other aesthetic, sociocultural, and economic fields. Perhaps the contagiousness of such cultures and their analog and digital sonic transmissions make them an audio portal, offering innovative techniques for synthesizing modes of collective assemblage, production, and distribution through the construction of temporary and mobile vibrational ecologies. These musical war machines are perhaps most accurately conceived as subpolitical. Rather than diminishing their importance, their subpoliticality is in fact crucial, potentiating an affective mobilization, underneath the segmentation of belief into ideological, territorial, affiliative, or gang camps, providing a vibrational infrastructure or platform for collectivity that supplements the picture painted in *Planet of Slums.* At the same time, their often subpolitical and microcapitalist nature confounds cultural studies' attempts to claim that every quantum of cultural production should be construed as an act of resistance or opposition to capitalism.

2003: Contagious Transmission 32

> The tower block, condemned as a vertical slum by a Control that would rather update its architectural dimension into forms more amenable to representation . . . becomes an "incubator." The thicker the forest of towers, the more antennae perched above the city, the more the Radiant City, botched, radiates.
>
> —Matt Fuller, *Media Ecologies* (2005)

The summer of 2003, holed up in a small room on the twelfth floor of a residential tower block in Bow, East London, the sweat running down the inside of the walls. The floor is carpeted in grime and dust. The room is built inside a larger room, a hastily constructed endo-architecture to cocoon the studio, protecting the pirate transmission and transmitters from intruders. The electrics are sporadic but functional. A decimated fan makes what little air there is circulate in the room, generating a turbulent microclimate of dust and smoke. Wires snake their way out of messily drilled holes (also working as steam valves), out through windows, trailing and flapping against the outside of the block, leading up to the transmitter on the roof. Inside this pirate radio studio, the megalopolis is screaming through the MCs at a rapid rate that seems to exceed the limits of the human system of vocalization. The pressure of millions channeled through a few mouths. They call out the name of their rivals in a lyrical assault and battery so cutting, so acerbic that even the DJ winces at the verbal violence as he drags the record backward, halting the proceedings only to return to the edge and roll again, this time building the intensity level that little bit higher.

For a moment, the scene freezes. The MC stops insulting and becomes an "encryptor."[1] His mouth becomes a modem, transmitting an asignifying stream of digits to the audience distributed across London's airwaves: "out to the 365, the 768, the 976, 315." Signaling that you are locked into the station's transmission is made by phoning the studio number, letting it ring once, then hanging up. Acknowledgment of this signal is provided by the host/DJ/MC reciting the last three digits of phone numbers from his log of missed calls on the studio handset. The connection made, the transmission swells, the rate of text messages incoming to the studio escalates, while the studio phone vibrates. Matt Fuller has noted how, within the media ecology of pirate radio, mobile phone rings "have developed as a way to use the telecommunications architecture at no cost to receiver or sender and to process a relatively large number of feedback signals at speed . . . they work as a password. In this case, they don't so much allow the user to gain access—they are that access."[2] Unusually one caller persists. A private number. Most callers hang up on one ring, the missed call functioning as a request code for the DJ to rewind the current track to the beginning. But the phone keeps ringing. The MC's focus shifts from his rivals to the DTI (Department of Trade and Industry), and now Offcom, the branch of the British state responsible for policing the radio spectrum.[3] "You know how we do . . . no private numbers. DTI get bun!" Answering the mobile phone to a private number potentially allows Offcom, monitoring signal transmissions over the airwaves, to locate the studio much more easily. A whole circuit of connections and disconnections, of contact and evasions. A veritable sonic war machine temporarily occupying a slice of radiophonic territory, hacking the national grid in a logistics of infection. Offcom—a centralized radio disease control agency monitoring outbreaks of "viracy" in the frequency spectrum.

Although London pirate radio has its own specific history of predator and prey, Offcom's low-intensity war on "viracy" now converges with a global tendency that has been tagged "war in the age of pirate replication."[4] Piracy, in all its strains, pulses blocks of affect in from the system periphery, either external or internal, feeding the viral nature of digital capitalism. The auditory dimension of this viral culture is exemplified by the contagious transmissions of East London pirate radio. Meanwhile, conceptually, a set of problems is thrown up by piracy, problems that demand some fine tuning of the audio virological approach.

An audio virology seeks to illuminate some of the affective dimensions of pirate radio. According to Gaston Bachelard in his essay "Reverie and Radio,"

radio engineers should be accompanied by what he calls a "psychic engineer" to aid in creating a mode of radio that communicates the unconscious: "It is through them that it will find a certain universality, and that is the reason for the paradox: the unconscious is something we know little about."[5] But the average pirate radio broadcast from East London is driven by what is more accurately described as "affect engineering," where the throbs of sonic contagion pulsed across the radio waves are processed directly on the body. As Fuller points out, the "sonic unconscious is material that is collectively produced and is gated and intensified by multiple layers of processing—it becomes malleable, potentiated, in reception. These are types of music that are fundamentally synthetic. They declare the whole spectrum of vibrations at any speed or frequency subject to their inventive power."[6] Cerebral radio listening is short-circuited to be overridden by the "full-body-ear-drum" of the skin, via a sometimes mobile, distributed network of bass delivery systems.[7]

An audio virology must take into account what Matt Fuller has recently termed the "affordances," "potentials," and "activated relations" of "media ecologies" within the shifting biotechnical meshwork of sonic culture. It draws attention to pirate radio's zones of transmission, incubation, its electromagnetic war for bandwidth, its bacterial nomadism within the vertical city, its asignifying contagious trade in numerical code and sonic fluids, and its power to generate virtual collectivity. Instead of merely making connections between individual cells, an audio virology probes the mutational potential of pirate media, asking what aesthetic transformations, what new modes of contagious collectivity and what rhythmic anarchitectures such sonic microcultures may provoke.

The first problem confronted by an audio virology concerns this planetary context of "war in the age of pirate replication." The early-twenty-first century is a strange time to be an audio pirate, whatever the strain. Under the slogan of "piracy funds terrorism," the war on terror has made a point of forging together the vast secret economies of pirated media (producing millions of unlicensed copies of CDs and DVDs, particularly from Southeast Asia), anonymous, illegal online file trading (using an array of p2p platforms) with ubiquitous, decentralized insurgency networks such as al Qaeda. From the point of view of agencies of control attempting to produce one global system, this multitude of targets is linked by the general dread of transmedial viral invasion—economic, electromagnetic, biological, terrorist, audiovisual. In fact, the virus constitutes the model for all threats to cybernetic control societies. Ubiquitous digitalization has intensified pirate replication, fueling the viral nature of cybernetic capital.

A second, and related, problem derives from the politicized discourse of underground media versus mainstream media and the mutual parasitism between them. Whether as a temporary autonomous zone of pirate utopia (Hakim Bey) in "parasitic rejection" of (Bruce Sterling[8]), or in a campaign of resistance through "symbolic warfare" (Simon Reynolds[9]) against major technocultural networks, the fear for anticapitalist pirates is of incorporation into the body of the beast that feeds off its innovations, depriving originators of their just rewards. However, such formulations have a tendency to become overly unilateral, ignoring the actual symbiotic relationships that characterize emergent media ecologies within the intrinsically viral culture of late capitalism. The complex intertwining plays out in relation to both radio and file trading culture. Pirate radio, for instance, is parasitic of a state media space only insofar as this bandwidth is already colonized by parasitic antimarket media systems. Who exactly is the bigger pirate here? Instead of incorporation modeled on the hierarchical binary of underground-mainstream, illegal-legal, an audio virology is more concerned with transversal propagation vectors across an array of standard and nonstandard sonic ecologies and new trading and transmission channels opened up by accident.[10] An audio virology must probe beyond the apparent contradiction between both the intellectual property protection and radio licensing and their violation, focusing instead on the complementary, symbiotic functioning of these media ecologies, expressed in the movements of pirate deterritorialization and formalized reterritorialization.

This complex symbiosis plays out in digital music markets as well as radio piracy. Is there really a necessary contradiction, for example, between unrestrained file trading and the subsequent reterritorialization of this into pay-for-downloads, or is it merely a change in speed of propagation? Trading activity is channeled through a labyrinth of credit card transactions, slowing transmission but simultaneously untapping a potential for escalation by feeding cash back into production labs and bolstering the zone of parasitic mediation that sustains corporate bodies in capitalizing on and monopolizing mass listening. Peer-to-peer file trading damages corporate margins, allows music to flow more freely (increasing the potential audience for the music), while simultaneously depriving some artists of income outside of the majors. Older critical models struggle to keep up with these complexities.

Once pirate and mainstream culture enter this tighter symbiotic relationship of affective contagion, the distinction between pirate or DIY microcultures and

a co-opting capitalism becomes flattened. Now a new problem emerges in relation to the possibility of identifying invention when it occurs. This problem of differentiating innovation from its capture is confounded by what Matt Mason has termed, in his book of the same name, *the pirate's dilemma*.[11] Mason, whose book often reads like an introduction to the youth culture of the past thirty years for corporate capitalists, is keen to sing the praises of the constructive power of cultural piracy in transforming capitalism to the point where we are all now, he claims, happy pirates.[12] Yet in his rush to celebrate decentralized networks, his argument often seems to whitewash the fact that power no longer needs to operate in a top-down fashion. The book starts off with the example of everyday sonic warfare in the form of signal jamming using merely an iPod and an iTrip. Mason runs through a list of similarly fascinating examples, from the effect on morale of pirate radio propaganda broadcasts from the world wars through to Vietnam and Iraq, through to underground music pirate networks in East London, even flirting with a virological theorization to correctly emphasize the aesthetic wealth of pirate culture in London: "Instead of exposing themselves on the open seas, this new breed of pirates began to operate cloaked in the anonymity of urban sprawl . . . the estimated 150 pirate stations on the FM dial in the United Kingdom act as musical Petri dishes—they have spawned new genres and cultures for decades, and attract as much as 10 percent of London's radio audience. . . . Pirate radio is an incubator where new music can mutate."[13]

Mason catalogs a long list of pirate invasions of media platforms, with innovative ideas and formats delivered in stealthy fashion, adopting various tactics of camouflage and anonymity. From the tidal waves of Schumpeterian creative destruction triggered by innovation in technology or technique, to the perpetual subversion, hacking, and remixing that the nonstandard use of these technologies facilitates, the law can only but lag behind. For Mason, this has signaled the end of top-down mass culture. Youth culture has reinvented, or rejuvenated, capitalism to the point that piracy has now become just another business model, a mutation from subversive cultural weapon to business plan; the situationist projection of art into the everyday becomes merely branding. So his instruction to capitalists is that to succeed, they should really compete with piracy instead of merely fighting it: "Pirates highlight areas where choice doesn't exist and demand that it does. And this mentality transcends media formats, technological changes, and business models . . . successful pirates adapt quickly to social and technological changes but this is true of all entrepreneurs. . . . Once these new

ideas are broadcast, they unavoidably create a pirate's dilemma for others in the market. Should they fight the pirates, or accept that there is some value in what they are doing, and compete with them?"[14]

In such a scenario, global and local pirate economics no longer merely function as a "parasitic rejection of the global order." Rather, these hybrid mixtures of formal and informal economy indicate a voracious turbulent globalization in which waves of innovation sweep in from the periphery that surrounds and transects the core in ever decreasing time loops between innovation and mass marketing. These time loops approach zero, shortened by the voraciousness of viral marketing, futurology, and cool hunting. This is the somewhat bleak side of his story that Mason fails to acknowledge. The challenge is whether pirate cultures can retain autonomy as major corporations switch from aggressive conflict to aggressive competition. Can they develop their own preemptive mechanisms to ward off capture? How exactly tactical media (localized do-it-yourself pragmatism engaged in jamming, hacking, and short-circuiting communication and power grids) at the periphery will continue to coalesce with sound system cultures and an aesthetic of mongrelized music is, of course, unpredictable and subject to local conditions. But perhaps it is this random element that is the most powerful weapon against attempts to preempt and harness their affective power.

2039: Holosonic Control

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Ever been stung by a Mosquito?[1] If you are over twenty-five, then probably not, according to the press release for one of the latest commercially available weapons in ultrasonic warfare. The Mosquito Anti-Social Device (M.A.D.), enthusiastically promoted by low-intensity warfare luminaries such as British daytime TV's Richard and Judy and GMTV (a gaudy, populist wake-up show) emits a high-frequency sound with an effective range of 15 to 20 meters, and is supposedly detectable only by youths. The press release continues, "Field trials have shown that teenagers are acutely aware of the Mosquito and usually move away from the area within just a couple of minutes. . . . Research has shown that the majority of people over the age of 25 have lost the ability to hear at this frequency range [roughly 16 to 20 kilohertz]. It should be borne in mind, however, that the unit usually has the desired effect—moving the crowds away—within just a few minutes, at which time the unit can be turned off." Could it be that property owners now have their own sonic weapon in the battle against hooded youth who have previously attacked their pacified soundscape with their voices, ring tones, pirate radio, and underground music infrastructures? Has ultrasonic warfare graduated to the High Street? Will anyone with the cash and inclination be zapping anyone who gets in their way? What does the commercial proliferation of such devices signal regarding current tendencies of the politics of frequency? If the pun can be excused, such emergent tactics in the modulation of populations suggest that the future of sonic warfare is *unsound.*

Unsound refers to the apparently paradoxical field of inaudible audio, infrasonic and ultrasonic. The Mosquito device, an adaption of technologies initially deployed as a means of rodent control, intervenes generationally through a differential in human hearing. As recent research has shown, the narrow fold in molecular vibration that constitutes the bandwidth of audibility is much more permeable and mutable than is normally assumed. It is hardly controversial to suggest that, as more has been learned about the neuroeffects of very high and very low frequency sound, and bionic audition develops, then the perceptual battlefields of sonic warfare have broadened.

One research team of Japanese scientists has focused on what has been termed *hypersonic effects*.[2] In this research it was suggested that not only did frequencies above 20 kilohertz affect the brain, but they also modulated human hearing within the audible bandwidth. Perceptual coding derived from psychoacoustic research led to the subtraction of frequencies that were not apparent to conscious perception, thereby, until recently, setting the standard, for example, for digital audio formats.[3] Yet research that has revealed nonconscious physiological effects of ultrasound and studies that have pointed to the extremely rich frequency environment of, for example, rain forests, have led many to begin to recognize the affects of virtual, inaudible sound using electroencephalogram and positron emission tomography scan techniques and by tracking the modulations of blood flow through the brain.

The hypersonic experiment was carried out on subjects noninvasively monitored while listening to Balinese Gamelan music that is said to be rich in ultrasonic frequencies. The frequencies were split into those that were audible and those that were inaudible. Brain activity was monitored when the person was exposed to one or the other, or both. When the ambient baseline of background sound and the higher-frequency sound were played together, it was clear that the very high frequencies were consciously unrecognizable. The conclusions of the research suggested that playing both the higher (inaudible) and lower (audible) bands together enhanced neuronal activity in the alpha frequency range,[4] in a way in which playing them separately did not. Subjects found exposure to both the audible and inaudible together more pleasing. The research found that what they called the hypersonic effect was not merely a neurophysiological response to certain high frequencies, but specifically the nexus of the these inaudible frequencies with the audible lower ones. The pleasing effect came from their complex resonance. This frequency nexus in steering alpha rhythms modulated the degree of relaxation and arousal.

In the hyperstitional project Hexen 2039, artist Suzanne Treister speculates on this virtual future of unsound.[5] Revolving around semifictional time-traveler Rosalind Brodsky of the Institute of Militronics and Advanced Time Interventionality (IMATi), Hexen projects the historical intersections between the military and the occult into the future, paying particular attention to sound technologies and their deployment within the military-industrial-entertainment complex. Treister's project and its corresponding exhibitions, equal parts history and science fiction, entailed a series of diagrams that both complicated and mocked the remote viewing sketches of military intelligence agents. The project illuminated a number of coincidences and resonances in the history of sonic technological innovations by Hollywood studios (such as Fantasound), generating a vortex of fact and fiction that spirals out deliriously. Hexen travels forward in time to 2039 to speculate on the use of the "Silent Subliminal Presentation System" patented by Oliver Lowery in 1992. As Richard Grayson points out in his essay on the Hexen 2039 project, there are a number of sources that tie Lowery's invention with actual experimental deployments of such "unsound" devices by the U.S. military in Guantanamo Bay and Abu Ghraib in Iraq. In the patent, Lowery's system is described as a



> silent communications system in which non-aural carriers, in the very low or very high audio-frequency range or in the adjacent ultrasonic frequency spectrum are amplitude or frequency modulated with the desired intelligence and propagated acoustically or vibrationally, for inducement into the brain, typically through the use of loudspeakers, earphones, or piezoelectric transducers. The modulated carriers may be transmitted directly in real time or may be conveniently recorded or stored on mechanical, magnetic or optical media for delayed or repeated transmission to the listener.[6]

In his book investigating the recent alleged psyops activities of the U.S. military, Jon Ronson noted that by 1996, Lowery had posted a note on his Web site stating that "all schematics have [now] been classified by the US Government and we are not allowed to reveal the exact details. . . . We make tapes and CDs for the German government, even the former Soviet Union countries! All with the permission of the US State department, of course. . . . The system was used throughout Operation Desert Storm (Iraq) quite successfully."[7] Refined and perfected by 2039, the silent subliminal presentation system in Hexen has become a refined instrument of preemptive power, a weapon of sharpened suggestion able to implant memories of a future not yet happened.

Back in the present, ultrasound deployed in the service of highly directional audio helps initiate this preemptive mode of audiosocial power. This holosonic



control marks a qualitative shift in the nature of perceived acoustic space. Holosonics, audio spotlights, or sonic lasers, as they are often called, work using inaudible, ultrasonic frequencies, which, due to the nonlinear yet predictable properties of air, become audible to those who stand in front of the beam.[8] Holosonic power constitutes perhaps the most significant phase shift in capitalism and schizophonia since the invention of the loudspeaker. It scrambles McLuhan's classic analysis of the opposition between acoustic and visual space, in which acoustic space is immersive and leaky, whereas visual objects of perception occupy discreet locations. Holosonic control shifts us therefore from the vibrational topology of the ocean of sound to the discontinuous, "holey" space of ultrasonic power.

Holosonic control operates through the nexus of directional ultrasound, sonic branding, viral marketing, and preemptive power. As such, it aims not merely to haunt you with acousmatic or schizophonic voices detached from their source. Neither, in its most invasive mode, does it merely seek to converge with mental voices from the past to form some kind of hauntological mode of capital. Instead, in line with the affinity to futurity of preemptive power, holosonic control intervenes to catalyze memories from the future—audio memories of events you have not actually experienced yet. Holosonic control's weapons of choice are "acoustic time anomalies," often resulting in symptoms of déjà entendu, literally the already heard. This sonic equivalent of déjà vu, the side effect of the propagation of audio viruses, sets up a structure of allure for products for which you had no desire, not just because you have not yet been seduced into desiring them but also because they do not necessarily actually exist yet.

Such high-frequency, hypersonic, and holosonic research also convergences with the speculative fiction of English writer J. G. Ballard who in his 1963 short story, "The Sound-Sweep," described the condition of inaudible, yet directly neuroaffective, music based around ultrasonic frequencies. Ballard described how, in this version of the future of music,

> ultrasonic music, employing a vastly greater range of octaves, chords and chromatic scales than are audible by the human ear, provided a direct neural link between the sound stream and the auditory lobes, generating an apparently sourceless sensation of harmony, rhythm, cadence and melody uncontaminated by the noise and vibration of audible music . . . raised above the threshold of conscious audibility. . . . A second advantage of ultrasonic music was that its frequencies were so high they left no resonating residues in solid structures, and consequently there was no need to call in the sound-sweep. . . . The whole thing was inaudible, but the air around Magnon felt vibrant and accelerated, charged with gaiety and sparkle.[9]

These weird schemes like silent discos (where dancers wear headphones),[10] ultrasonic concerts, and the holosonically generated acoustic time anomalies of the capitalized generation of desire all embody a micropolitics of frequency that favors higher-frequency (un)sounds, with desired effects ranging from eardrum-piercing pain through to enhancing "presence" and the clear delivery of messages, that is, efficient communication, and mitigates against messy, leaky, low frequencies with an affinity to hapticity, immersion, and congregation. It should be remembered that in Ballard's short story, the silent, yet directly neurally affective, ultrasound concert is set against the backdrop of the noise pollution of infrasonic rumbles, murmuring, reverberations, and other sonic detritus.

As with the perceptual encoding involved in the production of mp3s, such frequency discrimination, as Matt Fuller writes, tends toward the obliteration of

> the range of musics designed to be heard with the remainder of the body via bass. This is not simply a white technological cleansing of black music but the configuration of the organs, a call to order for the gut, the arse, to stop vibrating and leave the serious work of signal processing to the head. That's the sick part of it; another part is the way formats are decided on by "expert groups," committees defining standards for file formats and protocols that are supposedly open in procedure but where expertise, like those of hardcore methodologies, is defined in certain ways. Here, a fat bass becomes simply a particular Fourier transform mappable according to certain isolatable dimensions. Standard formation and non-standard uses create a recursive cycle that is always ongoing but never entirely predictable.[11]

It appears therefore that a major axis of sonic cultural warfare in the twenty-first century relates to the tension between the subbass materialism of music cultures and holosonic control, suggesting an invisible but escalating micropolitics of frequency that merits more attention and experimentation. Moreover, these developments should be placed in the wider context of the policing of the electromagnetic spectrum, particularly radio frequencies, but also extending out into the distribution of wireless networks, radar, and other imperceptible rhythms, transmissions, and emissions. The colonization of the inaudible, the investment in unsound research, indicates the expanding front line of twenty-first-century sonic warfare. While hypersonics probes the upper threshold of audibility, which can vary in relation to social segmentations such as age, or researches the neuroscientific effects of combinations of ultrasound with audible frequencies, bass materialist cultures concentrate on the seismological dimension of music, on sonic dominance, in both its physical and incorporeal forces.

While bass materialist cultures make tangible the physicality of the inaudible via the manufacture of vortical, tactile spaces, recent technological tendencies,

hand in hand with brain implantation of microchips soldered into the auditory cortex, smuggled in with their implicit politics of silence, seem to carry the desire to extinguish older modes of audition, operating instead through the direct modulation of the brain and rendering the audible spectrum redundant. Here, frequency modulation as a modus operandi of societies of control is taken literally, with cities and their populations attuned and entrained by the generation, modulation, oscillation, filtering, synthesis, and isolation of frequencies and amplitudes.

In the economy of attention, reality has become tunable. The micropolitics of frequency points toward the waves and particles that abduct consumers immersed in both the transensory and nonsensory soup of vibro-capitalism. The backdrop here is an electromagnetic environment that is saturated by radio and television broadcasting transmissions, police, military, air traffic control and meteorological radar, satellite communications systems, and microwave relay links. To the foreground lies the infrasonic and ultrasonic ecology of hydraulic gurgles, industrial rumbles, the seismology of traffic, a cultural tectonics and the synthetic birdsong of alarms, ring tones, bleeps, indicators, and crowd repellents.





For sure, a certain amount of paranoia accompanies this micropolitics of frequency and the immaterial sensuality that apprehends electronic entities distributed across the spectrum. The drift of high technology toward the imperceptible is accompanied by the deployment of technical sensors that transduce vibration, consciously imperceptible to the body, into code and neurocomputational signal. Machines that "couple and decouple with our bodies without us knowing. Working on microscopic scales, often pathogenic, many electromagnetic fields interfere with the cellular structure of the body. Paranoia accompanies dealing with such hertzian machines."[12]

Yet the virtual, unsonic city in which holosonic control operates is also a field of potential. What a body can hear is a question, not a forgone conclusion, for artists as well as security experts. Because vibrational ecologies traverse the nature-culture continuum, a micropolitics of frequency is always confronted by strange, unpredictable resonances. As Dunne argues, the computer maps that show the propagation of radio waves, for example, and the footprint of their field strength "reveal that hertzian space is not isotropic but has an electro climate defined by wavelength, frequency, and field strength arising from interaction with the natural environment."[13] This vortical energetic terrain in the interzone between the artificial and natural environment constitutes the atmospheric front of sonic warfare.

Conclusion: Unsound—The (Sub)Politics of Frequency

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Sonic Warfare has attempted to bring to the foreground some of the means by which audition is policed and mobilized. *Policing* here denotes not merely a repressive set of exclusions or limits, but a generative distribution of sensations that identify, channel, and amplify sonic power. What is distributed are those elementary pulses or throbs of experience constitutive of an aesthetic ontology that revolves around vibrational force and the prehension of affective tonality. Affective tonality can be felt as mood, ambience, or atmosphere. As film sound designers know only too well, certain frequencies can produce an affective tonality of fear in which the body is left poised in anticipation, expectant of incoming events: every pore listens for the future. Just think of the *uneasy listening* of atonal or discordant sound, or the sense of dread induced by low-frequency drones.

Affective tonalities such as fear, especially when ingrained and designed into architectures of security, can become the basis for a generalized ecology, influencing everything from microgestures to economics. As such, and unlike an emotional state, affective tonality possesses, abducts, or envelops a subject rather than being possessed by one. Possession, or affective contagion, has been discussed as the short-circuiting of attention and consciousness by mnemonic processes and the sonically induced, temporary, psychoaffective vacation of the present, leaving residues of feeling resembling auditory déjà vu or déjà entendu. It is in these dyschronic episodes of time lapse that predatory capital, in preemptive mode, can insert itself, mobilizing audio viruses to hook consumers

in advance for products that may not yet exist. The affective deployment of sound, we have also noted, may be more direct than the ominous tinting of atmosphere or mnemonic intervention. As we have also seen, the soft power of affective tone can be overridden by the immediate physicality of sonic violence where frequency is multiplied by amplitude into the sonic dominance of acoustic weaponry.

Sonic Warfare has therefore underlined the ways in which affective tonality in its broadest sense operates within a play of forces and that every nexus of sonic experience is immersed in a wider field of power. But not just any mode of power. By placing the discussion within the context of a mode of power-tagged preemption, a deliberate attempt has been made to align the text so that its comments do not bear just on past and present distributions of sonic sensations, but are keenly focused on futurity—the way in which the future is active virtually in and is anticipated by the present—hence, the speculative focus on the time anomaly of déjà entendu within virosonic branding, where the misleading sense of familiarity with something never experienced renders, more likely, a future disposition or affinity.

No doubt, the outline of preemptive power could leave one feeling despair that the invention of new modes of feeling is always already co-opted in advance, that control has morphed into becoming, and vice versa. With capital's drive to incite creativity ever intensifying, the difference between cultural invention and the cynical fabrication of invention begins to blur. Taking the example of piracy, some commentators have noted how it has become just another business model. And when the most banal popular music is simultaneously mobilized as a weapon of torture, it is clear that sonic culture has reached a strange conjuncture within its deepening immersion into the environments of the military-entertainment complex. However, the impasse of despair at such apparent undecidability would imply that the new is defunct and relegated to recycling. *Sonic Warfare* refuses this persistent, despairing echo of postmodernism.

Countering this despair, one of the threads that runs through the book, in tension with control's frequency modulation of affective tonality, finds in futurism's art of war in the art of noise, and Afrofuturism's revisions and updates, one of the most potent, if problematic, conceptualizations of the aesthetic mobilization of vibrational force. Implicit in futurism is an affective politics that goes well beyond its typecasting within music of "sounding futuristic." What was salvaged from futurism, after discarding its dubious political affiliations and compromised linear temporality, was an aesthetic politics as a tactics of

invention that suspends possibility for the sake of potential. *We do not yet know what a sonic body can do.* This potential was pinpointed using the concept of *unsound,* another name for the *not yet audible.* It describes the peripheries of human audition, of infrasound and ultrasound, both of which modulate the affective sensorium in ways we still do not fully comprehend. In its negative connotation, unsound aptly describes the colonization of inaudible frequencies by control. But most important, unsound also names that which is not yet audible within the normal bandwidth of hearing—new rhythms, resonances, textures, and syntheses. Most generally, then, unsound denotes sonic virtuality, the nexus of imperceptible vibration, masked due to limitations on not just the deficient physiology of the auditory system, but also the policing of the sensible enacted by groups defined by their affective affinities determined by taste, expertise, or other audiosocial predeterminations such as class, race, gender, and age. Traditionally sonic virtuality has been understood in relation to concepts such as silence and noise, with both offering, in different and sometimes conflicting, sometimes complementary ways, vehicles for thinking the aesthetic, cultural, or micropolitical potential of the audiosocial.

Together, the aesthetic politics of silence and noise has been a useful way of framing or demarcating the field of sonic power. For example, in the history of musical aesthetics, silence, from John Cage onward, has been conjoined to the virtual in that it constitutes the shadow of audition, the nonconscious background, perceivable only through absence and with only a negative possibility of entering conscious attention. Silence here is sound in potential, unactualized. Similarly, the concept of noise, from futurism onward, came to mean the potential of any sound whatsoever to disrupt and move forward musical jurisdictions as policed by generic criteria, critical border patrols, or harmonic or melodic parameters of organized sound.

Both of these aesthetic tendencies, within the remit of a politics of amplitude, are often placed in allegiance to an anticapitalist politics. In these cases, in noise pollution policy, for example, strategic resonances are recognized in local tactical interventions into the force fields of sonic ecologies. Yet the silence-noise axis has several drawbacks.

The politics of silence often assumes a conservative guise and promotes itself as quasi-spiritual and nostalgic for a return to a natural. As such, it is often orientalized and romanticizes tranquility unviolated by the machinations of technology, which have militarized the sonic and polluted the rural soundscape with noise, polluted art with sonification, polluted the city with industry, polluted

thought with distraction, polluted attention with marketing, deafens teenagers, and so on.[1] Its disposition is almost always reactionary. In a much less strong but more compelling aesthetic version, it sides with those lamenting the loss of dynamic range within the "loudness war" that currently rages concerning the overuse of compression in mastering techniques within sound engineering. Dynamic compression here, or at least its overuse, in maximizing loudness and minimizing dynamic range, is objected to as a weapon for enhancing the audio virological power of sonic capital while deadening affect in the hypercompetitive economy of attention.

The politics of noise, on the other hand, may become an excuse for relativism (one person's noise is another's music) or, in more militant mode, takes noise as a cultural weapon, as a shock to thought, as a shock to bourgeois complacency, as a shock to tradition, as a shock to the status quo.[2] The various positions that can be grouped under this heading revolve around an array of definitions of noise, from unwanted sound, to deconstructive remainder, systemic excess, void, or disturbance through to acoustic definitions based on distribution of frequency and tagged by colors—white, pink, black, and so on. Aesthetically, however, in the soundtrack to the politics of noise, its weapons often remain trapped within the claustrophobic confines of the dual (and usually white) history of rock music and avant-classical sound art. Justified by Adornian propaganda, the politics of noise may be enlisted to celebrate everything from the dreary to the monstrous, with sonic dominance narrowly construed as the overpowering taken to the point of meaningless parody—instead of a shock to thought, a provocation to boredom.

In its most convincing formulations, the negativity of the politics of noise is twisted into an engine of construction, and noise becomes a reservoir of rhythmic potential, a parasitic probe beckoning the future. Usually noise here, in a nontechnical sense, is black noise—the black noise of what Kodwo Eshun calls the futurhythmachine. It is to black noise that twentieth-century popular music owed most of its innovations. Black noise, painstakingly crafted in the context of enforced migration, depressed urbanism, and ethnic suppression, becomes a locus of affective collectivity. Feeling around in the dark, in the toxic smog of megalopian pressure, when no hope seems to exist, when no stability persists, rhythmic decisions still get made, collectives mobilized, and potential futures produced. The rhythmic breakthroughs of the electronic musics of the Black Atlantic have been countless.

What is certain is that the dialectics of silence and noise cannot contain the concept of sonic warfare developed here. Both the conceptual fetishization of noise and silence as a politics of amplitude is always arbitrary. Hence emphasis has been deliberately shifted to vibration—and therefore (micro) rhythm—as that discontinuum without which a "loud" or "quiet" sonic ecology would be inconceivable. Instead of obsessing on one or the other, it is clear that agencies of both control and enjoyment, or repressive and mobilizing forces, reserve the right to zigzag as and when it is pertinent to do so.

The problem of solely prioritizing the amplitude axis (between loudness and quietness) when considering the politics of sonic intensity is that usually it comes at the expense of a much more complex set of affective resonances distributed across the frequency spectrum. Some of these complexities have come out in our discussion of unsound, from infrasonic and ultrasonic deployments of sonic weapons through to the bass materialism of sound system cultures. In other words, to a micropolitics of amplitude must be added a micropolitics of frequency.

For sure, a more complete picture of the deployment of power within sonic ecologies would have to delve deeper into issues of political economy and language. But it is precisely the usual obsession with these two themes, within cultural theoretical attempts to politicize sound and music, and the blind spot that these dogmas have produced to date, that have made it impossible to take a properly ecological vantage point. They constitute only the tip of the iceberg. Yet for this very reason, some readers may understand sonic warfare, in its focused concern with this blind spot (and its only brief comments on economics via piracy and language via voice synthesis), as apolitical or, the preferable term, subpolitical.

Other readers may detect, particularly in the discussion of the sound system cultures of the *Planet of Slums* the suggestion of a latent, romantic notion of a musical multitude of the global proletariat. There is, however, a key difference between an argument about the affective mobilization and microcapitalist bootstrapping of the sound system cultures of the developing world and the internal peripheries of the core, on one hand, and the influential notion developed by Hardt and Negri in *Empire,*[3] of an antiglobalization movement as *creative multitude,* on the other.

The claims made in *Sonic Warfare* are much less grandiose. It is one thing to find a model of affective collectivity in the aesthetic invention, sensory engineering,

and economic hacking of these local and digitized musical movements; their force lies in their subpolitical, tactical, and aesthetic dimensions, as opposed to being primarily based on belief or ideology. It is another much more contentious move to make grand claims regarding the spontaneous politicality of the so-called emergent creativity of the multitude.

Where aesthetic and technological innovation, collective, affective, and economic mobilization, and social desegmentation coincide, the appropriate term for such cultures, following Deleuze and Guattari, may be *sonic war machines.* These sonic collectives may emerge out of turbulent, underdeveloped urban ecologies, but their bottom-up nature does not in itself constitute an index of a moral or political higher ground. Caution should be shown, for example, in celebrating the pirate economics of music cultures. Preemptive capital is now ingrained enough that, through the convoluted geometry of viral marketing, cool hunters, sonic branding, and journalism's voracious thirst for an angle, piracy is now conceived by some as just another corporate model, a new business school rhetoric for getting ahead of the curve. It is essential, therefore, to get things in perspective. The attraction and repulsion of populations around sonic affect, and the aesthetic politics that this entails, while only the substrata out of which sociality emerges, is still a battleground. Experiments with responses to frequencies, textures, rhythms, and amplitudes render the divergence of control and becoming ever diminishing. For better and for worse, audio viruses are already everywhere, spreading across analog and digital domains. The military makes nonstandard uses of popular music, while underground music cultures make nonstandard use of playback technologies, communications, and power infrastructures. As attention becomes the most highly prized commodity, the sonic war over affective tonality escalates. But as Deleuze would remind us, "There is no need to fear or hope, but only to . . . [listen] . . . for new weapons."[4]

Glossary

Abstract vorticism—mode of rhythmanalytic thought that derives from Lucretius's concept of the clinamen, and continued in the ideas of Illya Prigogine and Isabelle Stengers, Michel Serres on the birth of physics, and Gilles Deleuze and Felix Guattari's concept of the war machine. Abstract vorticism concerns itself with populations "far from equilibrium," turbulence, and the emergence of rhythm out of noise.

Acoustic cyberspace—defined by Erik Davis as a synthetic, affective, immersive, synesthetic, haptic space as opposed to the disembodied, Cartesian, visual model of digital space segmented by grids, lines, and points.

Acoustics—the physics of sound.

Actual occasions—the basic atoms of experience, as defined by Alfred Whitehead. Also referred to as a *throb* or *pulse of experience.*

Affect—Spinozist conception of the power of one body to interact with other bodies. The ontological glue of the universe. In its narrower definition, it diverges from psychoanalytical definitions that use it as synonymous with *emotion,* instead denoting collective dynamics in relation to mood, ambience, and atmosphere as registered across networked nervous systems. Theoretically denotes a plane ontologically prior to cognitive processes and the plane of representation. Concept developed further by Gilles Deleuze and Felix Guattari and by Brian Massumi.



Affective tonality—dimensions of mood, ambience, or atmosphere.

Afrofuturism—the intersection of black music with black science fiction. Generally understood as originating with Sun Ra in jazz, George Clinton in funk, and Lee Scratch

Perry in reggae. Chronicled by the Black Audio Film Collective in *The Last Angel of History/Mothership Connection* and Kodwo Eshun in *More Brilliant Than the Sun.*

Analog fetishism—adherence and prioritization of an ontology of continuity and flow. In sound, the fetishization of analog machines and sonics as truly authentic. Working together with digital futurism, constitutes a block to a rigorous conception of the sonic plexus.

Asymmetric warfare—conflict waged between two forces of radically unequal means. Refers to a range of tactics and strategies that take advantage of decentralized, rhizomatic networks. Resonates with strategies of guerrilla warfare and contemporary netwar.

Audio virology—theory and practice of cultural virology operating at the level of affective contagion, as opposed to the cognitive epidemiology of memetics.

Bass materialism—the collective construction of vibrational ecologies concentrated on low frequencies where sound overlaps tactility.

Déjà entendu—the weird experience of time anomaly, specifically the auditory equivalent of déjà vu, that is, the already heard, as opposed to the already seen.

Digital futurism—reductionist, fetishism of digital technology, or formalist, avant-gardist tendency in digital sound design and microsound theory and practice. Working together with analog fetishism, constitutes a block to a rigorous conception of the sonic plexus.

Ecology of fear—phrase coined by urban theorist Mike Davis to depict the affective climate of catastrophic urbanism, the city and its control systems as affected by the threat of natural, technological, sociopolitical, or economic disaster.

Futurism—the legacy of aesthetico-technical engagement deriving from the early modernist Italian art movement, for example, Marinetti, and characterized by an obsession with war, machines, speed, noise, and sensation and a naively linear conception of technological evolution. Noted in the history of experimental music for Rusollo's groundbreaking manifesto, *The Art of Noise.*

Futurity—immanence of the future in the present marked by anticipation or dread as a future feedback effect. The domain of preemptive control.

Global ghettotech—attempt to forge together a radically synthetic counter to "world music" that connects together the mutant strains of post-hip-hop, electronic dance music from the Planet of Slums, from kwaito to reggaeton, to cumbia, to dancehall, to crunk, to grime, to baile funk, and others.

Hard-core continuum—defined by journalist Simon Reynolds as a lineage of music in the U.K. that emerged out of the collision with acid house with the sonic processes of Jamaican sound system culture. The continuum stretches through strains of hard core, through jungle, drum'n'bass, 2step garage, grime, dubstep, bassline, and funky house.

Holosonic control—the convergence of direction ultrasound technologies with preemptive power for audio virological objectives. Produces the effect of déjà entendu, among others.

Hypersonic—inaudible affects of an ultrasonic encounter.

Infrasound—leaky, subbass frequencies under the auditory threshold of 20 hertz, often felt in terms of tactility or organ resonance instead of hearing.

Logistics of affection—distributed continuum of war machines (as opposed to military machines) generative of the mutation of sensation in cybernetic society. In an asymmetric relation to the logistics of perception.

Logistics of perception—phrase coined by Paul Virilio in relation to the control functions of militarized media culture in cybernetic society. In an asymmetric relation to the logistics of affection.

Megalopolis—multicentered urban sprawls ranging from 8 million to 30 million inhabitants. Key actors in the evolution of the human species in the twenty-first century.

Military-entertainment complex—The idea that target populations in wartime are also media audiences. Also refers to the migration of technologies and processes developed in the military sphere to everyday media culture.

Military urbanism—the migration of the architectures of security from war to the design of cities.

Nexus—a collective or society of actual entities that prehend each other, as defined by Alfred Whitehead. The nexus itself constitutes an actual entity in addition to the sum of entities out of which it is composed.

Planet of Slums—name for emergent, megalopian, and radically unequal urbanism of the twenty-first century (Mike Davis).

Preemptive power—a speculative, postdeterrence mode of power that attempts to colonize futurity by appropriating the future-anterior. Attempts to operate in advance of itself. Instead of attempting to ward off, prevent, or anticipate future events, preemptive power attempts to add a minimal dose of surety into an uncertain present, narrowing the window of the future by instigating threatened events, making them actualize, even if undesirable in the short term. Also known as science-fiction capital (Mark Fisher).

Prehension—a simple feeling, sensuous or nonsensuous (conceptual), as defined by Alfred Whitehead.

Rhythmachine—defined by Kodwo Eshun as the abstract machine of rhythm, connecting smaller information components perceivable only nonsensuously through pattern recognition. A parallel processing system enhanced by sonic science, with a potential to

reverse-engineer what a body can do. Reaches its hyperhythmic apex in the futurhyth-machine of U.K. dance music, jungle.

Rhythmanalysis—philosophy of rhythm as developed by Pinheros dos Santos, Gaston Bachelard, and Henri Lefebvre.

Rhythmic anarchitecture—the extensive continuum of Alfred Whitehead, or the nexus of all nexus. That which gives continuity to the atomic nature of actual occasions, the break and flows of matter.

Sonic plexus—the folded relationship between analog and digital sound culture.

Sonic warfare—deployment of sound systems in the modulation of affect, from sensations to moods to movement behaviors.

Subpolitics of frequency—the micropolitics of vibration that challenges the pervasive discrimination against low-end frequencies. Also refers to the apolitical or subpolitical, tactical nature of such a micropolitics, and therefore its possible appropriation by both active and reactive forces.

Throb of experience—a basic aesthetic component of actuality for Alfred North Whitehead.

Ultrasound—directional, high-frequency vibrations above the auditory threshold of 20 kilohertz.

Unsound—the not yet audible. Refers to the fuzzy periphery of auditory perception, where sound is inaudible but still produces neuroaffects or physiological resonances. Refers also to the untapped potential of audible bandwidths and the immanent futurity of music. Sonic virtuality.

Virtuality—concept of potentiality as developed by Henri Bergson, Gilles Deleuze, Pierre Levy, and Brian Massumi.

War machine—technical concept of Gilles Deleuze and Felix Guattari referring to a range of collective phenomena engaged in the active decoding and deterritorialization of strata. Can be conceptual, sonic, aesthetic, economic, political, animal, and so forth. When contrasted to military machines, war machines are differentiated by not taking conflict or violence as their primary object.

Notes

Introduction

1. Chris McGeal, “Sonic Boom Raids Cause Fear, Trauma,” *Guardian,* November 3, 2005, p. 6. See also “Sound Bombs Hurt Gaza Civilians,” http://www.taipeitimes.com/News/world/archives/2005/11/04/2003278681, and “Living with Supersonic Booms,” http://www.ynetnews.com/Ext/Comp/ArticleLayout/CdaArticlePrintPreview/1,2506,L-3161359,00.html. In 1986, the United States was taken to the International Court of Justice by Nicaragua for using similar tactics.

2. See Harlan Ullman and James Wade, Jr., *Shock and Awe: Achieving Rapid Dominance* (Washington, D.C.: National Defense University, 1996), for the strategic manual.

3. The term *ecology of fear* is borrowed from critical urban theorist Mike Davis, who, in his book of the same name, discusses the impact of natural catastrophe on urbanism. See Mike Davis, *The Ecology of Fear: Los Angeles and the Imagination of Disaster* (New York: Picador, 1998).

4. Psychoanalytic discussions of emotion use a much narrower definition of *affect.* While the literature on shell-shock and trauma certainly resonates with the discussions that follow, the aim is to draw from and construct a wider definition of the term.

5. This broad definition of *affect* is drawn from a theoretical lineage that stretches from Spinoza to Gilles Deleuze and Guattari and, most recently, the work of Brian Massumi.

6. Such a method crashes the codes and structures that organize the cultural analysis of sonic and music culture as text, plunging instead into the materiality of sensation, revealing, on the way down, the operations of power that distribute vibration and produce

sonic affects. This process of hacking opens onto a preindividual and impersonal virtual ecology. Only an aesthetic method can connect with the sensations produced through this decoding and destructuration, composing them into new modes of affective mobilization. This method intersects with that outlined by Felix Guattari in *Chaosmosis,* trans. P. Bains and J. Pefanis (Sydney: Power Institute, 1995). The sense of ethics discussed here resonates also with that of Deleuze, via Spinoza. That is, ethics does not refer to a morality of the "other" but rather strictly remains at the level of the pragmatics of sonically constructive and destructive encounters. Ethics here therefore remains neither moral nor strategic. It is beyond good and evil, and therefore it is somewhat indifferent to politics as usually understood.

7. Suzanne Cusick, "You are in a place that is out of the world . . .": Music in the Detention Camps of the 'Global War on Terror.'" *Journal of the Society for American Music* 2, no. 1 (2008): 1–26.

8. Kodwo Eshun, "Abducted by Audio," *Abstract Culture,* no. 12 (1997), Ccru.

9. The military-entertainment complex suggests the shared techniques, resources, and content of these two sectors, in addition to interlocking corporate infrastructures and ideological persuasions. As Stockwell and Muir argue, it also implies the idea, hammered home by "shock and awe," that the enemy in war is also an audience. S. Stockwell and A. Muir, "The Military-Entertainment Complex: A New Facet of Information Warfare," *Fibreculture,* no. 1, http://journal.fibreculture.org/issue1/issue1_stockwellmuir.html. 2000.

10. The phrase *sonic evangelism* is derived from Jonathan Sterne's depiction of the "audio-visual litany" in *The Audible Past* (Durham, N.C.: Duke University Press, 2003), pp. 14–19 in which he points to an almost religious tendency in many critiques of the ocularcentrism of Western culture, and the deification of the phenomenology of sound over the other sensory modalities, devoid of technological, history, and political inflection. The renaissance in studies of sonic culture coincides with the transformations of digital culture, particularly the ubiquity of the personal computer as sound studio, and builds on the preexisting domain of experimental musicology, cultural studies of popular music, but upgrades and moves beyond both fields.

11. The phrase *full-spectrum dominance,* as used here, is a deliberate generalization of a strategic concept that came out of the Pentagon in 2000 entitled *Joint Vision 2020,* http://www.dtic.mil/jointvision/jvpub2.htm, as a response to the problems posed by asymmetric warfare. I specifically deploy the concept to frame the field of a politics of frequency and to refer to the expanded remit of "unsonic" culture that currently exceeds human auditory perception, from infra- to ultrasound.

12. The military-entertainment complex suggests the shares techniques, resources, and content of these two sectors, in addition to interlocking corporate infrastructures and ideological persuasions. As Stockwell and Muir argue, it also implies the idea, hammered

home by "shock and awe," that the enemy in war is also an audience. Stockwell and. Muir, "The Military-Entertainment Complex."

13. Brian Massumi, "Potential Politics and the Primacy of Pre-emption," *Theory and Event* 10, no. 2 (2007), and "Fear (The Spectrum Said)," *Positions: East Asia Cultures Critique* 13, no. 1 (March 2005).

14. Mark Fisher, "Science Fiction Capital," 2001, http://www.cinestatic.com/trans-mat/Fisher/sfcapital.htm.

Chapter 1

1. Afrofuturism tries to break with many of the stereotypes of black music culture that tie it to the "primitive" as opposed to the technological, the "street" as opposed to the cosmic, and "soul" as opposed to the mechanical. While many have construed it to side with the last, its more compelling version focuses on the tension between "soul" and "postsoul" tendencies.

2. Paul Gilroy, *The Black Atlantic: Modernity and Double Consciousness* (London: Verso, 1993).

3. Gottfried W. Leibniz, *Epistolae ad diversos,* vol. 2, trans. C. Kortholt, (Leipzig, 1734), p. 240. The work of ethno-mathematician Ron Eglash hints at the binary mathematics implicit within Afro-diasporic polyrhythm cultures. See his articles "African in the Origins of Binary Code" and "Recursive Numeric Sequences in Africa," *Abstract Culture* 4, Ccru, 1999, and "African Influences in Cybernetics," in *The Cyborg Handbook,* ed, C. H. Gray (London: Routledge, 1995).

4. Kodwo Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), p. 103.

5. Ibid., p. 121.

6. Ccru, "Digital Hyperstition," *Abstract Culture,* Ccru, Swarm 4, 1999.

7. Reynolds in particular follows the migration of sonic warfare memes around the Black Atlantic. See "Wargasm: Military Imagery in Pop Music," originally published in *Frieze.* These quotes are taken from the expanded director cut available online at http://critcrim.org/redfeather/journal-pomocrim/vol-6–virtual/wargasm.html (last viewed April 3, 2006). He charts in particular the influence of Hong Kong martial arts films on the U.S. hip-hop collective, the Wu Tang Clan's mythology of "Liquid Swords," and then into the U.K. hard-core and jungle scenes of the early 1990s. Reynolds also notes, on another U.S.-to-U.K. vector, the migration of Detroit techno outfit Underground Resistance's notion of guerrilla warfare on vinyl to pioneering hardcore/jungle label Reinforced.

8. "Wargasm."

9. Immanuel Wallerstein, *World-Systems Analysis: An Introduction* (Durham, N.C.: Duke University Press, 2004).

10. Afrofuturism has also been understood as a response to the idea that "authenticity" in black music must necessarily be tied to "keeping it real," to the "street," chaining the essence of "blackness" to the conditions of depressed urban existence with all the stereotypes of sex, drugs, violence, and hyperconsumption that this contemporary cliché, filtered through a globalized hip-hop culture, entails. James Richards has referred to this simulation as the Ghetto Matrix, in which the ghetto becomes "a virtual reality (or more accurately: an actual surreality)" (James Richards, "The Ghetto Matrix," http://blackfilm.com/0205/features/a-ghettomatrix.shtml, 2000), an image (bought into by both American blacks and whites) deployed in the lucrative perpetuation of the prison, music, sports, and fashion industries—a vast and profitable carceral archipelago. The notion of a "ghetto matrix" can be useful, especially in an era in which some are suggesting an alternative to world music that strings together those local mutant music cultures of the Planet of Slums into a meta-movement termed "global ghettotech." With the spotlight of ubiquitous media intensifying, through the penetrating glare of everyone from global brands through to music bloggers, is the idea of a music underground, operating "off the radar," over? Are the depressed urban conditions that have motivated invention now merely a marketing image used in the perpetuation of stasis? *Sonic Warfare* refuses this postmodern impasse, finding, camouflaged in the hype, a resilient set of concepts and processes.

Gilroy's concept of the Black Atlantic begins to hack this matrix by challenging the two positions whose dualism helps shore up its dimensionality, essentialism and anti-essentialism, black nationalism and postmodernism. But Kodwo Eshun pushes this further, bracketing this crisis of representation. The war of images and identities for Eshun peels back to reveal a sonic materialism, and a war in which what is at stake is the "redesign of sonic reality" itself: "Everywhere, the street is considered the ground and guarantee of all reality, a compulsory logic explaining all Black Music, conveniently mishearing antisocial surrealism as social realism" (Eshun, *More Brilliant Than the Sun,* p. 4). Instead, the Afrofuturism that Eshun identifies attempts to fabricate an "operating system for the redesign of sonic reality" through the construction of an acoustic cyberspace and a new machinic distribution of sensations, escaping the terrestrial phenomenology of the ghetto matrix for a both cosmic and submarine model of movement and sensation.

Chapter 2

1. The conceptualization of the war machine developed here is inspired by Gilles Deleuze and Guattari's notion within *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988). Specifically, the (dis)continuum of war developed here is understood as stretched out between two tendencies: the tendency of capture and that of escape.

2. Russolo argues that between the partitioned pitches of the harmonic scale lies the "enharmonic." The scale leaves out "the true shading" of the "passage from the highest pitch

to the lowest." "These enharmonic passages, from one pitch to another, which are also found in the whistling of the wind and in the howling of sirens, are completely unknown to today's orchestras, which can produce only diatonic-chromatic passages." L. Russollo, *The Art of Noises* (Hillsdale, N.Y.: Pendragon Press, 1986), p. 51. Russolo's also drew from his colleague, Francesco Balilia in noting that futurist "enharmonism" facilitates "the natural and instinctive modulation and intonation of the enharmonic intervals, presently unattainable given our scale in the tempered system, which we want to overthrow. We Futurists have long loved these enharmonic intervals, which we find not only in the discords of the orchestras, when the instruments are playing in different systems, but in the spontaneous songs of the people, when they are pitched without the preoccupation of art" (pp. 64–65).

3. Russollo, *The Art of Noises,* pp. 49–50. Giving examples of the symphony of noises of war, Russolo describes the "murmuring thunder" of artillery out of range, outlining a futurist cartography of space. "But it is only when it comes within range that the artillery reveals completely the epic and impressionistic symphony of its noises. Then the pounding of the firing acquires a timbre of metallic crashing that is prolonged in the howl of the shell as it rips through the air, losing itself in the distance as it falls. Those coming in, however, are announced by a distant, breathless thump, by a progressively louder howling that takes on a tragic sense of impending menace, ever greater and closer, until the explosion of the shell itself. The whistling of the shell in the air with the different calibers. The smaller the caliber, the higher and more regular the whistling. With larger calibers, there are added other, smaller ones, with surges of intensity. With the very largest calibers, there is a noise very little different from that of a train passing nearby" (p. 50).

4. Russolo's influential formulation of the sound/war nexus also outlines the haptic navigation in the battlefield environment: "In modern warfare, mechanical and metallic, the element of sight is almost zero. The sense, the significance, and the expressiveness of noises, however, are infinite. . . . From noise, the different calibers of grenades and shrapnels can be known even before they explode. Noise enables us to discern a marching patrol in deepest darkness, even to judging the number of men who compose it. From the intensity of rifle fire, the number of defenders of a given position can be determined. There is no movement or activity that is not revealed by noise." Ibid., pp. 49–50.

5. Yet we can identify a number of distinct yet overlapping definitions of noise. First, one everyday use relates to distortion in a textural surface. If we take the listening experience of pirate radio, for example, we may attribute part of the affective charge to the dose of static interference, which intensifies the sensation of the music heard, intensifies the conjunction of music and the nervous system, as if the frayed edges of percussive and verbal rhythmicity roughen the skin like aerodynamic sandpaper, making it vulnerable, opening it to rhythmic contagion. Usually, however, noise is taken negatively, in an essentially psychoacoustic fashion, which states that noise is relative and is an unspecified or unwanted sound. Within acoustics is a range of physical definitions, usually given the names of colors such as white, black, or pink, which often refers to degrees of

randomness within specific distributions of frequency. A further notion relates to the use of the word *noise* (as entropy, for example) in information theory. Finally, and perhaps most relevant here, is the chaos theoretical deployment of "noise" as positive chaos or turbulence. This also converges with the constructive conceptions of noise being developed in scientific research into processes of stochastic resonance in which the addition of noise into a nonlinear system can, at very particular thresholds, improve, not destroy, the transmission of a signal. See B. Kosko, *Noise* (New York: Viking, 2006). Instead of noise chained solely to a negative definition as unwanted, nonmusic, nonidentity, or incomprehensibility, we shall pursue instead the mode of vibrational matter that exceeds the binary between noise and signal, chaos and order, violence and peace. Noise as weapon of destruction becomes a field of virtual potential. Such a positive conception of noise is actually implied, though usually underdeveloped, in any compelling notion of noise as a weapon.

6. Jacques Attali, *Noise,* trans. B. Massumi (Minneapolis: University of Minnesota Press, 1985), p. 27.

7. Gilles Deleuze and Guattari, *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988), pp. 343–344.

8. Schizophonia, splitting sounds from their sources, is the notion coined by R. Murray Schaffer in *The Soundscape* to describe the rupture that the invention of recording imposed on the soundscape.

9. From an excerpt from Varese's lectures, "391," no. 5 (June 1917), New York, translated by Louise Varese.

10. Simon Reynolds, *Bring the Noise* (London: Faber and Faber, 2007), p. xii.

11. Ibid.

12. On occularcentrism, see Marshall McLuhan, "Visual and Acoustic Space," in *The Global Village* (New York: Oxford University Press, 1992), and "Acoustic Space" in *Media Research: Technology, Art, Communication,* ed. M. Moos (Amsterdam: G&B Arts, 1997), Erik Davis, "Acoustic Space," http://www.techgnosis.com/acoustic.html (last viewed May 2, 2005,) through to Martin Jay's *Downcast Eyes: The Denigration of Vision* (Berkeley: University of California Press, 1994) and Jonathon Stern's *The Audible Past* (Durham, N.C.: Duke University Press, 2003).

13. See, for example, M. Bull and L. Back, *The Auditory Culture Reader* (Oxford: Berg, 2003).

14. The affective turn in cultural theory is most rigorously formulated by Brian Massumi, *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002). Massumi understands affect as the intermodal, synesthetic perspective of the virtual. On synesthesia, see Barron Cohen, *Synesthesia: The Strangest Thing* (New York: Oxford University Press,

2001); R. Cytowic, *Synesthesia: A Union of the Senses* (Cambridge, Mass.: MIT Press, 2002), and J. Harrison and S. Barron Cohen, *Synesthesia: Classic and Contemporary Readings* (London: Blackwell, 1996).

15. Massumi's introduction to *Parables of the Virtual,* "Concrete Is as Concrete Does," condenses these problematic obsessions of cultural studies succinctly.

16. Attali, *Noise,* p. 25.

17. See Michel Chion's distinction between semantic, causal, and reduced listening in *Audio Vision* (New York: Columbia University Press, 1994).

18. Attali, *Noise,* p. 27.

19. Curtis Roads, *Microsound* (Cambridge, Mass.: MIT Press, 2001), p. 7.

20. This refers to a basic distinction that underlies this book. This distinction can be found in the history of military thought that opposes state to guerrilla warfare; see, for example. Robert Taber, *The War of the Flea* (Boulder, Colo.: Paladin, 1970). In the contemporary period, this maps on to what Arquilla and Ronfeldt described in their infamous article for the Rand Corporation, "Cyberwar Is Coming," *Journal of Comparative Strategy* 12, no. 2 (1993) . Cyberwar is a high-tech, state-centered militarization of network society and the electromagnetic spectrum, while netwar is an array of nonstate deployments, decentralized, and usually but not always nonviolent. The most profound and far-reaching version of this conceptual distinction can be found in Deleuze and Guattari's *A Thousand Plateaus,* between apparatus of capture and the nomad war machine. Adapting Deleuze and Guattari's schema, this text aims to reframe debates around the micropolitics of sound and music in terms of the pragmatics of sonic war machines.

21. Brian Massumi, *The Politics of Everyday Fear* (Minneapolis: University of Minnesota, 1993), p. 12.

Chapter 3

1. Project Jericho was broadcast on BBC Radio 3 on February 25, 2006.

2. http://www.forteantimes.com/articles/153_sonicweapons.shtml (last viewed May 3, 2006).

3. See, for example, chapter 15, "War without Bloodshed" in Alvin and Heidi Toffler's *War and Anti-War: Survival at the Dawn of the 21st Century* (Boston: Little, Brown, 1993). This book in fact fits into a much larger body of war research, but particularly aims to complement both Martin van Creveld's histories of war and Manual De Landa's materialist philosophy of war in *War in the Age of Intelligent Machines* (New York: Zone, 1992) with a more affective analysis of popular culture and aesthetics. See also Elias Canetti's *Crowds and Power* (New York: Penguin, 1992) for an analysis of the physics of crowds.

4. M. Cloonan and B. Johnson, "Killing Me Softly with His Song: An Initial Investigation into the Use of Popular Music as a Tool of Oppression," *Popular Music* 21, no. 1 (2002).

5. S. Cusick, "Music as Torture/Music as Weapon," *Transcultural Music Review,* no. 10, 2006, at http://www.sibetrans.com/trans/trans10/cusick_eng.htm

6. Combining Michel Foucault and Gilles Deleuze with Marshall McLuhan, it could be argued that the mode of security has expanded from the surveillance of panoptics, which models the target in terms of its visual field, to pansonics, the subtle yet ubiquitous modulation of control in an immersive, synesthetic field closer to McLuhan's descriptions of acoustic space.

7. Infrasonic waves are generated by an array of turbulent phenomena in the physical world, from earthquakes, erupting volcanoes, and tidal waves to meteorological entities such as hurricanes and thunderstorms. Such frequencies are known to induce anxiety among animals, which have broader auditory bandwidths and less control over their autonomic responses than humans do.

8. Hyperstition, a concept developed by the Ccru (www.ccru.net), relates to fictional entities or agencies that make themselves real. The classic example is William Gibson's concept of cyberspace from the 1980s.

9. One of the earliest mentions of Gavreau (or Gavraud, as some sources spell his name) stems from Lyall Watson's *Supernature* (New York: Coronet, 1974).

10. Gavreau, "Infrasound," pp. 379–380, in S. Sweezey, *Amok Journal Sensurround Edition: A Compendium of Pyscho-Physiological Investigations* (Los Angeles: Amok, 1995). See also Cody, J. "Infrasound," 1996, http://www.borderlands.com/archives/arch/infra.htm and G. Vassilatos, G "Nocturnal Disturbances and Infrasonic Hum," 1996, http://www.borderlands.com/archives/arch/nux.htm6.

11. Ibid., p. 382.

12. Christian Nold, *Mobile Vulgus* (London: Book Works, 2001), p. 66. The Curdler was also said to have also been used by police in the Bay Area of California in the 1960s to dissolve crowds and their production of noises such as clapping or chanting.

13. "Deadly Vibrations," in http://www.overloadmedia.co.uk/archives/miscellaneous/deadly_vibrations.php (last viewed July 5, 2005).

14. John Pilger, *Heroes* (Boston: South End Press, 2003), p. 198.

15. "The Wandering Soul Psy-op Tape of Vietnam," http://www.pcf45.com/sealords/cuadai/wanderingsoul.htm. This Web page features an audio clip of one of the tapes used, a number of reports on the campaign, and the Vietnamese Buddhist conception of the wandering souls of the dead on which it was based.

16. *New Scientist,* September 20, 1973, in Swezey, *Amok Journal,* p. 399.

17. According to SouthCom Network (SCN) radio, which supplied the music on request by the U.S. troops, the playlist (with probably a few errors) included: "(You've Got) Another Thing Coming"—Judas Priest; "Fifty Ways to Leave Your Lover"—Paul Simon; "All Over But the Crying"—Georgia Satellites; "All I Want Is You"—U2; "Big Shot"—Billy Joel; "Blue Collar Man"—Styx; "Born to Run"—Bruce Springsteen; "Bring Change"—Tears for Fears; "Cleaning Up the Town"—The Bus Boys; "Crying in the Chapel"—Brenda Lee; "Dancing in the Street"—David Bowie; "Danger Zone"—Kenny Loggins; "Dead Man's Party"—Oingo Boingo; "Don't Look Back"—Boston; "Don't Fear the Reaper"—Blue Oyster Cult; "Don't Close Your Eyes"—Kix; "Eat My Shorts"—Rick Dees; "Electric Spanking of War Babies"—Funkadelic; "Feel a Whole Lot Better (When You're Gone)"—Tom Petty; "Freedom Fighter"—White Lion; "Freedom—No Compromise"—Little Steven; "Ghost Rider"—The Outlaws; "Give It Up"—KC and the Sunshine Band; "Gonna Tear Your Playhouse Down"—Paul Young; "Guilty"—Bonham; "Hang 'Em High"—Van Halen; "Hanging Tough"—New Kids on the Block; "Heavens on Fire"—Kiss; "Hello It's Me"—Todd Rundgren; "Hello, We're Here"—Tom T. Hall; "Helter Skelter"—The Beatles; "I Fought the Law and the Law Won"—Bobby Fuller; "If I Had a Rocket Launcher"—Bruce Cochran; "In My Time of Dying"—Led Zeppelin; "Ironman"—Black Sabbath; "It Keeps You Running"—Doobie Brothers; "Judgement Day"—Whitesnake; "Jungle Love"—Steve Miller; "Just Like Jessie James"—Cher; "Mayor of Simpleton"—XTC; "Midnight Rider"—Allman Brothers Band; "Mr. Blue"—The Fleetwoods; "Naughty Naughty"—Danger Danger; "Never Gonna Give You Up"—Rick Astley; "Never Tear Us Apart"—INXS; "No Particular Place to Go"—Chuck Berry; "No More Mister Nice Guy"—Alice Cooper; "No Alibis"—Eric Clapton; "Now You're Messin' with an S.O.B."—Nazareth; "Nowhere Man"—The Beatles; "Nowhere to Run"—Martha and the Vandelas; "One Way Ticket"—George Thorogood and the Destroyers; "Panama"—Van Halen; "Paradise City"—Guns and Roses; "Paranoid"—Black Sabbath; "Patience"—Guns and Roses; "Poor Little Fool"—Ricky Nelson; "Prisoner of the Highway"—Ronnie Milsap; "Prisoner of Rock and Roll"—Neil Young; "Refugee"—Tom Petty; "Renegade"—Styx; "Rock and a Hard Place"—Rolling Stones; "Run to the Hills"—Iron Maiden; "Run Like Hell"—Pink Floyd; "Screaming for Vengeance"—Judas Priest; "She's Got a Big Posse"—Arabian Prince; "Shot in the Dark"—Ozzy Osborne; "Stay Hungry"—Twisted Sister; "Taking It to the Streets"—Doobie Brothers; "The Party's Over"—Journey; "The Race Is On"—Sawyer Brown; "The Pusher"—Steppenwolf; "The Long Arm of the Law"—Warren Zevon; "The Star Spangled Banner"—Jimi Hendrix; "The Secret of My Success"—Night Ranger; "They're Coming to Take Me Away"—Henry VIII; "This Means War"—Joan Jett and the Blackhearts; "Time Is on My Side"—Rolling Stones; "Too Old to Rock and Roll, Too Young to Die"—Jethro Tull; "Voodoo Child"—Jimi Hendrix; "Wait for You"—Bonham; "Waiting for a Friend"—Rolling Stones; "Wanted Dead or Alive"—Bon Jovi; "Wanted Man"—Molly Hatchet; "War Pigs"—Black Sabbath; "We Didn't Start This Fire"—Billy Joel; "We Gotta Get Outta This Place"—The Animals; "Who Will You Run To?"—Hear; "You Send Me"—Sam Cooke; "You Shook Me All Night Long"—AC/DC;

"You Hurt Me (and I Hate You)"—Eurythmics; "You Got Lucky"—Tom Petty; "Your Time Is Gonna Come"—Led Zeppelin; "Youth Gone Wild"—Skid Row. http://www.gwu.edu/~nsarchiv/nsa/DOCUMENT/950206.htm.

18. See chapter 12 in J. Ronson, *The Men Who Stare at Goats* (New York: Picador, 2004). Ronson traces the recent history of U.S. psyops, including the deployment of silent subliminal sound, to the frankly unhinged *First Earth Battalion Operating Manual* of Jim Channon. See http://firstearthbattalion.org/?q=node/26

19. See Cusick, "Music as Torture/Music as Weapon," and Clive Stafford Smith, "Welcome to the 'Disco,'" *Guardian,* June 19, 2008, http://www.guardian.co.uk/world/2008/jun/19/usa.guantanamo.

20. See the LRAD product overview at http://www.atcsd.com/site/content/view/15/110/ (last viewed April 4, 2009).

21. For a recent report on LRADs, see Jurgen Altmann's Millimetre Waves, Lasers, Acoustics for Non-Lethal Weapons? Physics Analyses and Inferences (Deutsche Stiftung Friedensforschung, 2008). For Altmann's earlier debunking of the hype over acoustic weaponry, see Altmann "Acoustic Weapons—A Prospective Assessment" (*Science and Global Security* 9, 2001: 165–234.).

22. Amy Teibel, "Israel May Use Sound Weapon on Settlers," June 10, 2005, http://news.yahoo.com/news?tmpl=story&u=/ap/20050610/ap_on_re_mi_ea/israel_the_scream (last viewed June 3, 2006).

23. http://www.acoustics.org/press/137th/altmann.html (last viewed April 23, 2005).

24. Ibid.

25. Rob Young, "Exotic Audio Research," *Wire,* March 1997.

26. See in particular William Burroughs, "Electronic Revolution," in *Word Virus* (New York: Grove Press, 1999), pp. 294–313.

27. William Burroughs and J. Page, "The Jimmy and Bill Show," in Swezey, *Amok Journal,* ed. S. Swezey (Los Angeles: Amok, 1995), p. 376.

28. J. Sergeant "Sonic Doom," *Fortean Times,* no. 153, December 2001, also available at http://www.forteantimes.com/articles/153_sonicweapons.shtml (last viewed September 3, 2005), chapter 12 in Simon Reynolds, *Rip It Up and Start Again* (London: Faber and Faber, 2006), Simon Ford, *The Wreckers of Civilization* (London: Black Dog, 2001), and V. Vale and A. Juno, eds., *The Industrial Culture Handbook* (San Francisco: Re/Search Publications, 1985).

29. http://www.klf.de/faq/index.php?inte_id=6 According to the KLF Web site, Cauty allegedly deployed one of his vehicles at a road protest in Devon: "As of 2300 hrs 19.10.96

the armoured division of the A.A.A. Formation Attack Ensemble established a front line defensive position at the Trollheim Hill Fort, Fairmile, Devon, in collaboration with A30 Action in defence of the threatened trees, badgers and some insects. At dawn on 21.10.96, the Triple A will activate their S.Q.U.A.W.K. 9000 sonic device in response to any offensive action taken on behalf of the Connect consortium. The autonomous communities of Fairmile, Trollheim and Allercombe have resisted the soul destroying consumer nightmare of the private profit A30 through a 2 year campaign of Non-Violent Direct Action. Now armed with the 2 Saracen armoured personnel carriers both loaded with 15 Kilowatt Sound systems and weighing over 10 tons they intend to dance in the face of the legions of destruction."

30. When Wagner's "Ride of the Valkyries" was blasted out of General Kilgore's swarm of helicopters in *Apocalypse Now,* it was supposed to provide a high-octane soundtrack to massacre for the U.S. troops, to get the adrenaline pumping but also to terrify the villagers below with its pompous Euro-classical bombast. In George Gittoes's recent documentary, *Soundtrack to War* (Revelation Films, 2007), U.S. tank operators in Iraq were interviewed about the kind of music they liked to listen to while going into battle. Many of the soldiers hacked the wiring of their tanks so they could plug their CD players into the communication system and share the music with their comrades using their helmet earphones. The troops were roughly split along the lines of race in their preference for their killing accompaniment. While the white soldiers tended to listen to metal and hard core, the African American soldiers preferred hip-hop. In both cases, however, what was needed to help pump the adrenaline was a testosterone-driven soundtrack.

Chapter 4

1. Elias Canetti, *Crowds and Power* (New York: Penguin, 1992).

2. Julian Henriques, "Sonic Dominance and the Reggae Sound System Session," in *The Auditory Cultures Reader,* ed. M. Bull and L. Back (London: Berg, 2003), p. 453.

3. Jose Gil, "The Dancer's Body," in *A Shock to Thought: Expressions after Deleuze and Guattari,* ed. B. Massumi (London: Routledge, 2001), p. 124.

Chapter 5

1. Friedrich Kittler, *Gramophone, Film, Typewriter,* trans. G. Winthrop-Young and M. Wutz (Stanford, Calif.: Stanford University Press, 1999). There are numerous intriguing twentieth-century entanglements of military technology with popular music culture. See, for example, Albert Glinsky's *Theremin: Ether Music and Espionage* (Bloomington: University of Illinois Press, 2000). Kittler himself notes that when "Karlheinz Stockhausen was mixing his first electronic composition, Kontakte, in the Cologne studio of the Westdeutcscher Rundfunk between February 1958 and fall 1959, the pulse generator,

indicating amplifier, band-pass filter, as well as the sine and square wave oscillators were made up of discarded U.S. Army equipment: an abuse that produced a distinctive sound" (p. 97). Winthrop-Young points out how modern hi-fi technology built on innovations in aircraft and submarine location technologies and how radio stations exploited the VHF signal processing that guided General Guderian's tank blitzkrieg. With Kittler, he goes on to use the Beatles' "Yellow Submarine" as a metaphor for our immersion in a "military-music" complex. He describes how on "11 September 1944 . . . US forces liberating Luxembourg and its famous radio station came across an extraordinary magnetophone that, to the amazement of Allied radio monitors, had allowed for a lifelike and scratch-free fidelity of sound that ordinary transcription records could never have yielded. While the commercial production of magnetic recording systems at Bell Labs was actively suppressed by upper management despite the fact that during the 1930s, Clarence Hickmann had already developed them to the point of practical application, the German development was fuelled by the need for superior combat recording technologies and for improved means to analyze and manipulate secret Morse messages. Subsequently, information gathered from captured German code-breaking equipment 'enabled EMI to manufacture tape and tape recorders, resulting in the production of the famous BTR series which remained in use at Abbey Road for over 25 years.' The strange dispatches allegedly encoded by Abbey Road's most famous clients including the tidings that 'Paul is dead'—presupposed machines of German counterintelligence had used for decoding enemy transmissions . . . the birth of full frequency range recording out of the technology of early submarine sound detection and identification practices. In 1940, faced with the prospect of losing the Battle of the Atlantic to German wolf packs, the RAF Coastal Command had approached the English-owned Decca Record Company with a secret and difficult assignment. Coastal Command wanted a training record to illustrate the differences between the sounds of German and British submarines. Such aural distinctions were extremely delicate and to reproduce them accurately on a record called for a decided enlargement of the phonograph's capabilities. Intensive work . . . led to new recording techniques." G. Winthrop-Young, "Drill and Distraction in the Yellow Submarine: On the Dominance of War in Friedrich Kittler's Media Theory," *Critical Inquiry* 28 (2002): 3–4

2. Kittler, *Gramophone, Film, Typewriter,* p. 97.

3. "Records that hitherto had been used to liven up military communication in the trenches of the Ardennes now came into their own. Otherwise people themselves, rather than the government and the media industry, could have made politics." Ibid., p. 97. As Winthrop Young elaborates in "Drill and Distraction," "The scenario that emerges and which some would no doubt label paranoid is one of the military only consenting to the civilian use of a media technology if it is too outdated to serve military purposes or if it is certain that its release into the civilian world will have no negative impact on military operations . . . . Beginning in May 1917, primitive tube transmitters were used to transmit early radio programs along the trenches, but the upper echelons quickly put a stop to such abuse of military hardware. With the demobilization of almost 200,000 radio operators still in possession of their equipment and the revolutionary unrest following

the lost war, however, the incipient republic was in danger of losing control of its recently acquired airwaves" (p. 835).

4. F. Kittler, "Infowar," http://www.hydra.umn.edu/kittler/infowar-tr.html Ars Electronica Festival, 1998, Linz, Austria, September 7–12 (last viewed April 2, 2004)

5. See particularly Martin van Creveld, *Technology and War: From 2000 B.C. to the Present* (New York: Free Press, 1991), and Manuel De Landa, *War in the Age of Intelligent Machines* (New York: Zone, 1992.

6. With reference to historical material, such interpretations of Kittler's work have already been seriously undermined by showing that in fact in many cases, war often hindered technological development. See G. Winthrop-Young, "Drill and Distraction in the Yellow Submarine."

7. M. Foucault, *Discipline and Punish,* trans. A. Sheridan (New York: Penguin, 1979), and *Society Must Be Defended,* trans. D. Macey (New York: Penguin, 2003).

8. Gilles Deleuze and Felix Guattari, "Nomadology," in *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988).

9. Kittler, *Gramophone, Film, Typewriter,* p. 110.

10. Ibid., p. 140.

Chapter 6

1. Virilio understood both the military general and film director as strategists negotiating the "fog of war" within the logistics of perception. And their roles mutate in tandem as the vision machines assemble and connect: "To grasp the objective truth of a great battle, the camera eye . . . could not have been that of the general or the director. Rather, a monitor would have had to have recorded and analysed a number of facts and events incomparably greater than what the human eye and brain can perceive at a given place and time, and then to have inscribed the processed data onto the battlefield itself. . . . The level of foresight required by the geopolitical dimensions of modern battlefields demanded a veritable meteorology of war. Already we can see here the video-idea that the military voyeur is handicapped by the slowness with which he scans a field of action overstretched by the dynamic revolution of weaponry and mass transport. . . . The disappearance of the proximity effect in the prosthesis of accelerated travel made it necessary to create a wholly simulated appearance that would restore three dimensionality to the message in full. Now a holographic prosthesis of the military commander's inertia was to be communicated to the viewer." Paul Virilio, *War and Cinema: The Logistics of Perception* (London: Verso, 1989), p. 59.

2. Paul Virilio, *Bunker Archeology* (Princeton, N.J.: Princeton Architectural Press, 1994).

3. See R. N. Scarth, *Mirrors by the Sea: An Account of the Hythe Sound Mirror System* (Hythe, U.K.: Hythe Civic Society, 1995). and R. N. Scarth, *Echoes from the Sky: A Story of Acoustic Defence* (Hyth, U.K.: Hyth Civic Society, 1999).

4. Virilio, *War and Cinema,* p. 83. The notion of the virtual (as potential) here owes more to Massumi than to Virilio (simulation as substitution) or Baudrillard (simulation as the implosion of the real into the hyperreal).

5. See Douglas Richardson, *An Illustrated Guide to Techniques and Equipment of Electronic Warfare* (London: Hodder & Stoughton, 1985), pp. 34–40.

6. François Julien, *The Propensity of Things,* trans. Janet Lloyd (New York: Zone, 1999), p. 25.

7. Ibid., pp. 30–31.

8. Julien also sees in the difference the origins of the Greek idea of assembly versus the Chinese concept of authority.

9. Ibid., p. 35.

10. Ibid., p. 26.

11. "Chinese strategy aimed to use every possible means to influence the potential inherent in the forces at play to its own advantage, even before the actual engagement, so that the engagement would never constitute the decisive moment, which always involves risk. In contrast, after the time of the skirmishes and duels described by Homer, the Greek ideal was the 'all or nothing' of pitched battle." Ibid., p. 35.

12. Ibid., p. 35.

13. Ibid., pp. 37–38.

Chapter 7

1. www.ghostarmy.org. Philip Gerard, *Secret Soldiers: How a Troupe of American Artists, Designers, and Sonic Wizards Won World War II's Battles of Deception against the Germans* (Penguin, 2002).

Gerard describes in detail these exercises: "But as the night wears on, the picture clarifies. A listening post up stream reports sounds of bridge building, while the listening post miles down stream at the fixed bridge point reports hearing a column of tanks veer off the road before reaching the bridge, detouring upstream along the river behind a screen of dense trees and darkness. . . . Other listening posts concur. The tanks are counted as their treads rumble across the wooden bridge, still heading upstream. Another listening post counts them again as, one by one, they gear down to climb a hill. A third listening post farther on confirms the count as the sound of exhaust cuts out momentarily

when they crest the hill and skid down the other side. The observers can't see any tank movement—but they've got ears. They're close enough to the river to pick up every move the Americans make, purely by sound. Finally, the listening post that reported the sounds of bridge building now reports that the racket of steel-on-steel hammering has ceased. A new sound has taken its place; tanks forming up and idling, then shutting down their engines. . . . Now there is no doubt. The prefabricated bridge upstream is finished. The American tanks will advance across it, trying to outflank the Germans. The General makes the decision that will seal their fate. 'Proceed as planned'" (p. 101). And yet the "battle just described never took place. It was staged for a top-secret training film scripted by Darrel Rippeteau, shot on location at Pine Camp, produced at the Signal Corps studio in Fort Monmouth, New Jersey, starring B-movie actors and real sonic soldiers. . . . The sonic deception it portrayed was very real. . . . At strategic points across the river, invisible behind the thick forest, stationary sonic cars played programs of sound effects specifically produced to create an impression of a tank moving up the river. . . . First, the sonic car upstream began playing the sounds of bridge building. Then, as the real tanks stopped short of the fixed bridge downstream, another sonic car switched on its sounds of tank engines. At intervals, each new car stationed farther upriver switched on its program—tanks crossing a wooden bridge with loose boards, tanks climbing a hill, tanks descending, tanks assembling at the new bridge head and then shutting down to wait for the assault. The cars downstream one by one shut down, and the sound magically 'moved' along the river upstream. . . . The sonic soldiers had rehearsed exactly such a scenario on the Black River near Pine Camp. The objective: to force the enemy to repel a sonic attack and thereby be caught unawares by the real one" (p. 102). "First, they set up their recording studio in a manoeuvre area near the Salt River. A tripod-mounted microphone—an off-the-shelf commercial studio brand—was the key. They affixed to it a wire basket covered in burlap to screen out wind noise. Cable snaked along the ground to the radar van, a hundred or so feet away. Inside the van, two technicians manned the turntables, on which a worm fear drove a recording head, etching grooves into a sixteen-inch glass-based transcription disk, the same kind used by radio and recording studios, thereby recording the input from the outside microphone. . . . As the needle scored the glass disk, one technician peered through a microscope at the recording head to make sure that the sound input was not so loud that it caused the stylus of the recording head to cut across one groove into the next and spoil the recording. The other kept a sharp eye on the oscilloscope, the glowing TV-like monitor that showed sound frequencies and moving waves on its cathode ray tube, offering a real-time picture of what they were recording. The technician could watch for spikes in volume and adjust the levels accordingly. . . . To record starts, idling, and backing up, the tanks were kept a hundred feet from the mike. For manoeuvring, he'd direct them farther and farther way, have them return, then order them to circle again and again. . . . Circling around the fixed microphone was a key manoeuvre, as the Bell Labs engineers pointed out. 'In this way, the collective sound of motor vehicles of the required type and number is obtained continuously and at high level, free of the revealing Doppler effect'" (p. 109). The "metallic clatter of bridge building, truck and jeep noise, soldiers' voices, artillery tractor

engineers, bulldozers grading roads, and military activity that could possibly be useful in mounting a deception. Then they selected sound effects for specific training exercises and dubbed them from fragile glass disks onto the more rugged stainless steel wire. . . . He [Ted Cruz] could grab a platter and slip the needle into the groove precisely on the desired sound effect. . . . At the Army Experiment Station, they worked in a studio above the airplane hangar. But they could also create sonic programs in their mobile studio, which contained three turntables off which they could dub sound to four wire recorders apiece. Thus, preparing for action they could tailor a dozen wire spool recordings at a time to the particular mission of deception, mixing armoured noise with voices, bridge building, and so on" (p. 111).

2. "Sound propagation over distance is much better at night . . . because there tends to be an inversion layer which makes the sound waves bend toward the earth. The inversion usually extends from the earth up to about ten feet. It's what is called 'inversion fog' which you can see in early mornings on the highway. . . . In practice, the sonic units would rarely try to project their music beyond six thousand yards—about three and half miles—the optimum distance for ranging accuracy. And they would target listeners between 5 and 30 feet above the transmitting vehicles. The sound ranging tables cover the three types of battlefield most ideal for sonic deception; flat open terrain, flat lightly wooded terrain, and flat heavily wooded terrain." Ibid., p. 115.

3. "In practice, it meant that if all vehicle sounds were recorded moving past the microphone in a straight line, first sounding louder and then fainter, then projected later over a great distance, they would sound fake because the frequencies would rise or fall in a haphazard fashion. It would be impossible to project a continuous sound located in space. This was the biggest problem of commercially available recorded sound effects and the main reason the army had to create its own library of tactical sounds." Ibid., pp. 109–110.

4. Ibid., p. 105.

5. Ibid., pp. 106–107.

6. Ibid., pp. 105–106.

Chapter 8

1. According to Jean-François Augoyard and Henri Torgue, the sound object as formulated by Pierre Schaeffer is "a practical and empirical point of view, it describes the interaction of the physical signal and perceptive intentionality, without which there would be no perception. From the theoretical point of view, it is a phenomenological quest for the essence of sound. Finally, from the point of view of instrumentation, the sound object is intended to be the elementary unit of general and multidisciplinary solfege of sounds." The problems for them of the category of the sound object is that "even with

the ever-increasing possibilities offered by real-time analysis, if the sound sequence is slightly complex or is spread over time, or if conditions of production are taken into consideration in situ and not simply simulated, then sound by sound analysis become extremely ponderous . . . [and] can hardly be used as a fundamental concept for the description and analysis of urban sounds" (p. 6). At the other end of the spectrum from the sound object, the macroconcept of the soundscape, as opposed to the microsound object, Augoyard and Torgue reject R. Murray Schafer's idea of the soundscape as a "masterpiece of nature." The soundscape here is not just the "sound environment" but more "what is perceptible as an aesthetic unit in a sound milieu. Shapes that are thus perceived can be analyzed because they seem to be integrated into a composition with very selective criteria. One of these criteria, the selection of hi-fi soundscapes—is justified from both an aesthetic and an education perspective. . . . However the application of the criteria of clarity and precision discredits a number of everyday situations impregnated with blurred and hazy (not to say uproarious) sound environments, which would belong to the 'lo-fi' category." So, they argue, we "lack the generic concepts to describe and design all perceptible sound forms of the environment, be they noisey stimuli, musical sounds, or any other sounds. The concept of the soundscape seems too broad and blurred, while the sound object seems too elementary (in terms of levels of organization), to allow us to work comfortably both at the scale of everyday behaviour and at the scale of architectural and urban spaces." J.-F. Augoyard and H. Torgue, eds., *Sonic Experience: A Guide to Everyday Sounds,* trans. A. McCartney and D. Paquette (Montreal: McGill-Queens University Press, 2005), pp. 6–7.

2. Greg Lynn. "Blob Tectonics, or Why Tectonics Is Square and Topology Is Groovy" in *Folds, Bodies and Blobs* (La Lettre volée, 1998).

3. Augoyard and Torgue, *Sonic Experience,* p. 10.

4. Ibid., p. 9.

5. William James, *Essays in Radical Empiricism* (New York: Dover, 2003).

6. B. Massumi, *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002), p. 14.

7. "The word is a blend of the Greek words for 'sensation' (aisthesis) and 'together,' or 'union' (syn), implying the experience of two, or more sensations occurring together." J. Harrison and S. Barron Cohen, eds., *Synaesthesia: Classic and Contemporary Readings* (London: Blackwell, 1996), p. 3.

8. Gilles Deleuze and Felix Guattari, *A Thousand Plateaus,* trans. B. Massumi (London, Athlone, 1988), attribute, in the context of this haptic, synesthesic field of affect, a specific piloting role to sound. Synesthesia is not for them "reducible to a simple color-sound correspondence . . . [they] induce colors that are superimposed upon the colors we see, lending them to a properly sonorous rhythm and movement." For them, this role is not based on the "signifying or 'communicational' values (which, on the contrary, presuppose

that power), nor to physical properties (which would privilege light over sound), but to a phylogenetic line, a machinic phylum that operates in sound and makes it a cutting edge of deterritorialization . . . music is plugged into a machinic phylum infinitely more powerful than that of painting: a line of selective pressure" (pp. 347–348). On the relation between music and color, Messiaen remarked that he was "affected by a kind of synopsia, found more in my mind than in my body, which allows me, when I hear music, and equally when I read it, to see inwardly, in the mind's eye, colours which move with the music, and I sense these colours in an extremely vivid manner. . . . For me certain sonorities are linked with certain complexes of colour and I use them as colours, juxtaposing them and putting them into relief against each other." Olivier Messiaen, *Music and Color—Conversations with Claude Samuel* (New York: Amadeus, 1994), pp. 16–17.

9. Stephen Connor notes that while the sonic is celebrated by the avant-garde as "the most disruptive sense," it is "also an insufficiency, in that the auditory always leads to or requires completion by the other senses. The instability of the auditory self is such that it dissolves the very autonomy, which seems to bring about the psychic unseating of the visual in the first place. . . . It resonates beyond itself. . . . It is not in a pure, autonomous faculty of audition that the greatest effect of the revival of the prestige of the acoustic has been seen. Rather, it has been in the very principle of relativity that defines the acoustic, the insufficiency that makes it impossible for the acoustic to stand alone. So bizarrely, the most far-reaching effects of the return of the acoustic may be in the transformations it has allowed in visual concepts and ways of feeling." Hearing for Connor operates as the switchboard/matrix facilitating intrasensory contact and mutation: "Where early modern technologies extended and amplified the powers of ear and eye, contemporary technologies offer the prospect of sensory recombination and transformation as well. The digitalization and consequent universal convertibility of information may make the synesthesias dreamt of by the late nineteenth and early twentieth centuries a common actuality, creating new aggregations of the visual, auditory, haptic and olfactory senses. Undoubtedly the dominance of vision in the constitution of the self would be put at risk in such a new sensory dispensation, since that dominance depends upon the separation of the senses one from another, and the existence of vision as an arbitrating meta-sense, capable of distinguishing, overseeing and correcting the operations of the other senses." Connor, "The Modern Auditory I" in *Rewriting the Self: Histories from the Renaissance to the Present,* ed. Roy Porter (London: Routledge, 1996), pp. 219–220.

10. Michel Chion, *Audio Vision* (New York: Columbia University Press, 1994), p. 135.

11. Ibid., p. 134.

12. "The eye carries information and sensations only some of which can be considered specifically and irreducibly visual (e.g., color); most others are transensory. Likewise, the ear serves as a vehicle for information and sensations only some of which are specifically auditive (e.g., pitch and intervallic relations), the others being, as in the case of the eye, not specific to this sense. However—and I insist on this point—transensoriality has nothing to do with what one might call intersensoriality, as in famous 'correspondences'

among the senses that Baudelaire, Rimbaud, Claudel and others celebrated . . . i.e. the idea of intersensoriality: each sense exists in itself, but encounters others at points of contact. . . . In the transensorial or even metasensorial model, which I am distinguishing from the Baudelarian one, there is no sensory given that is demarcated and isolated from the outset. Rather the senses are channels, highways more than territories or domains. If there exists a dimension in vision that is specifically visual, and if hearing includes dimensions that are exclusively auditive, these dimensions are in a minority, particularized, even as they are central. . . . When kinetic sensations organized into art are transmitted through a single sensory channel, through this single channel they can convey all the other senses at once. Silent cinema on one hand, and concrete music on the other clearly illustrate this idea. Silent cinema, in the absence of synch sound, sometimes expressed sounds better than could sound itself, frequently relying on a fluid and rapid montage style to do so. Concrete music, in its conscious refusal of the visual, carries with it visions that are more beautiful than images could ever be." Ibid., p. 137.

13. Ibid., p. 136.

Chapter 9

1. Jacques Attali, *Noise: Political Economy of Music* (Minneapolis: University of Minnesota Press), p. 11.

2. Istvan Csicsery-Ronay, Jr., in L. McCaffery, *Storming the Reality Studio: Casebook of Cyberpunk and Postmodern Science Fiction* (Durham, N.C.: Duke University Press, 1992) p. 190. McLuhan notes that since the invention of the telegraph, humans have been putting their nerves on the outside of their bodies. This "outering of the skin" and other vulnerabilities of the exteriorized interior is the root for McLuhan of our electronic unease, and he remarks that the birth in 1844 of the first commercial telegraph in America coincided with the publication of Kierkegaard's *The Concept of Dread*. See Marshall McLuhan, *Media Research: Technology, Art and Communication* (London: Routledge, 1997), p. 121.

3. Paul Virilio, *War and Cinema* (London: Verso, 1989), p. 3. The problem of military vision, for Virilio, is related to information gathering, transfer, and processing. The more sophisticated the vision machines of war, the more overpowering the sheer weight of information to be dealt with. The more overexposed the battlefield becomes, the more appearance gives into an array of camouflage, decoys, jamming, smokescreens, and electronic countermeasures. To be seen is to be taken out. One can no longer merely invest in forces, but must also invest in their concealment. Stealth, secrecy, and the logistics of perception signal, for Virilio, that the war of images and sound had superseded the war of weaponry. The coevolution of weapons and armor is paralleled by the coevolution of visibility and invisibility—the emergence of electromagnetic weapons of rendering objects perceptible such as radar and sonar. "The projectile's image and image's projectile form a single composite" (p. 83). But the increasing speed of the "ballistics of projectiles and the hyperballistics of aeronautics" are counterbalanced by the fact that "only the speed of

film exposure is capable of recording the military secret which each protagonist tries to keep by camouflaging ever larger objects" (p. 71). So the "problem then is no longer one of masks and screens, of camouflage designed to hinder long range targeting; rather, it is a problem of ubiquitousness, of handling simultaneous data in a global but unstable environment where the image (photographic or cinematic) is the most concentrated, but also the most stable form of information" (p. 71). The body or object disappears, to be replaced by the detected patterns, vibrations, sounds, and smells registering on technological sensors; "each of the antagonists feel both that he is watched by invisible stalkers and that he is observing his own body from a distance" (p. 72). As that which must be "acquired, pursued or destroyed," the projectile is a screen glyph and the television picture "an ultrasonic projectile propagated at the speed of light" (p. 83).

4. Marshall McLuhan, "Visual and Acoustic Space," in *The Global Village.* (New York: Oxford University Press, 1992), p. 40.

5. Jacques Attali, *Noise: the Political Economy of Music,* trans. B. Massumi Minneapolis: University of Minnesota Press, 1985), p. 11.

6. Ibid., p. 10.

7. D. Kahn, *Noise, Water, Meat: A History of Sound in the Arts* (Cambridge: MIT Press, 2001), p. 376.

8. Attali, *Noise,* p. 32.

9. Jacques Attali, "Ether Talk," *Wire,* no. 209 (July 2001): 73.

10. Ibid., p. 73.

11. Jacques Attali, *The Labyrinth in Culture and Society* (Berkeley, Calif.: North Atlantic Books, 1999), p. xxviii.

12. Ibid., p. xxviii.

13. Ibid., p. xxiv.

14. Ibid., pp. 53–54.

15. There are significant parallels to McLuhan's interest in the acoustico-synesthetic sensibility of the electronic age and the corresponding turbulent dynamics of twenty-first-century geotribal tension. Attacked for its technodeterminism and naive utopian neoprimitivism from within the discipline of cultural studies, it is at least worth pointing out that for McLuhan, the "global village absolutely insures maximal disagreement on all points. It never occurred to me that uniformity and tranquillity were the properties of the global village. It has more to do with spite and envy. The tribal village is far more divisive—full of fighting—than any nationalism was. Village is fission, not fusion, in depth." McLuhan, "Visual and Acoustic Space," pp. 57–58.

16. Simon Reynolds, *Energy Flash* (New York: Picador, 1998), pp. 370–371.

Chapter 10

1. Luigi Russolo, *The Art of Noises* (Hillsdale, N.Y.: Pendragon Press, 1986), p. 25.

2. Ibid., p. 24.

3. Ibid., p. 27.

4. Ibid., p. 29.

5. Ibid., p. 50.

6. Marinetti quoted in ibid., p. 26.

7. Ibid., p. 49.

8. Ibid., p. 50.

9. F. T. Marinetti, *Selected Writings,* ed. R. W. Flint (London: Secker and Warburg, 1972), p. 95.

10. Ibid., p. 45.

11. Paul Virilio, *Speed and Politics* (Los Angeles: Semiotexte, 1991), p. 62. Afrofuturism, at least as processed by Kodwo Eshun in *More Brilliant Than the Sun* (London: Quartet, 1998), breaks from the futurist tradition in several important senses. First, while the Italian futurists celebrated the advance of technology without questioning linear progress, Afrofuturism has a much more sophisticated conception of time and technology. Not only is history cyclical instead of linear, but Africa is sent into the future of science, as opposed to degree zero from which Western thought progresses. On this point, see also the Afro cybernetics of Ron Eglash, "African Influences in Cybernetics" in C. Hables-Gray, *The Cyborg Handbook* (London: Routledge, 1995). Second, Afrofuturism's sonic weaponry is not primarily noise in the futurist sense, but more fundamentally polyrhythm.

12. Gilles Deleuze, *Spinoza: Practical Philosophy* (San Francisco: City Lights, [1970] 1988), p. 123.

Chapter 11

1. Chris Marker, *La Jetée,* Argos Films, 1962.

2. Kodwo Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), p. 3.

3. Brian Eno, "Dialogue with Kevin Kelly," *Wired,* May 1995.

4. Eshun, *More Brilliant Than the Sun,* p. 1.

5. Kodwo Eshun, "Further Considerations on Afrofuturism," *CR: The New Centennial Review* 3, no. 2 (Summer 2003): 289.

6. Ibid., p. 289.

7. Ibid., p. 290.

8. Ibid., p. 297.

9. Ibid., pp. 296, 298.

10. Ibid., p. 295.

11. Ibid., p. 291.

12. Ibid., p. 295.

13. Kodwo Eshun and Edward George, "Ghostlines: Migration, Morphology, Mutations" in *Sonic Process* (Barcelona: Barcelona Museum of Contemporary Art, 2003.

14. Alfred North Whitehead, *Science and the Modern World* (Free Press, 1925), p. 259.

Chapter 12

1. The sobering subtext of the ecology of fear is that environmental, meteorological, and epidemiological catastrophe are coldly indifferent to the economic status of populations (although the relation of wealth to taking precautionary or rehabilitative measures is obvious.)

2. Mike Davis, *The Ecology of Fear* (New York: Vintage, 1999), p. 364.

3. Ibid., pp. 366, 367.

4. Ibid., p. 368.

5. Some have gone so far as to attribute the religious feeling of dread and awe experienced within cathedrals, for example, merely to the relation between their sonic architecture as resonance chamber and the imperceptible infrasonic vibrations emitted by pipe organs.

6. Bigend in William Gibson's *Pattern Recognition* (New York: Penguin, 2003), p. 57.

7. But it has been argued here that futurism can be built on through a reexamination of its orientation to temporality, reenergizing it as a set of tools for engaging with contemporary modes of aesthetic power.

8. The affective sensorium consists of the nexus of sensory modalities. The exteroceptive (facing the external environment of the body) five senses must be supplemented by

the proprioceptive (the feeling of the relational movement of muscles and ligaments, enfolded tactility) and viscerality. Interoceptive, viscerality "anticipates the translation of the sight or sound or touch perception into something recognizably associated with an identifiable object . . . viscerality subtracts quality as such from excitation. It registers intensity . . . [and] registers excitations gathered by the 5 "exteroceptive" senses even before they are fully processed by the brain." In B. Massumi, *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002), pp. 60–61.

9. Joachim-Ernst Berendt, *The Third Ear* (Perth, Australia: Element, 1985), p. 79.

10. Olive Lewin, *Rock It Come Over: The Folk Music of Jamaica; with Special Reference to Kumina and the Work of Mrs. Imogene "Queenie" Kennedy* (Kingston, Jamaica: University of the West Indies Press, 2001), p. 158.

11. Ibid., p. 164.

12. Ibid., p. 158.

13. A useful exception from the domain of film theory is Steven Shaviro's pioneering *The Cinematic Body* (Minneapolis: University of Minnesota Press, 1993).

14. Interview with Gasper Noe by Exposure Magazine at http://www.fullspectrumottawa.com/directors/gaspar_noe.php.

15. As R. M. Shaffer wrote, "In Greek mythology the Sirens were nymphs who destroyed those who passed their island by means of their singing, at once so piercing yet dulcet as honey. Circe warned Odysseus of the Sirens and so enabled him to elude their fatal song by plugging the ears of his men with wax and having himself bound to the mast of his ship. The Sirens thus signify mortal danger to man and this danger is broadcast by means of their singing. There is good evidence that the Greek word *siren* may be etymologically related to the words for *wasp* and *bee.* Modern man has re-identified the concept of danger with the wasp's song. There is an obvious similarity also between the glissando wail of the original siren and the human cry of pain or grief, diminished, however, since the introduction of the yelp siren with its sudden switch-on-switch-off technique. . . . The siren speaks of disharmony within." *The Soundscape* (Rochester, Vt.: Destiny Books, 1993), p. 178.

16. Heinz von Foerster, "Sounds and Music," in *Music by Computers,* ed. H. V. Foerster and J. W. Beauchamp (New York: Wiley, 1969), p. 3.

Chapter 13

1. Joseph Ledoux, *The Emotional Brain* (New York: Simon and Schuster, 1996), p. 158.

2. Brian Massumi, *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002),pp. 60–61.

3. See Erin Manning, "Prosthetics Making Sense: Dancing the Technogenetic," *Fibreculture,* 2006, http://journal.fibreculture.org/issue9/issue9_manning.html.

4. William James, *The Principles of Psychology* (New York: Dover, 1890.)

5. Brian Massumi, "The Future Birth of the Affective Fact," in *Conference Proceedings: Genealogies of Biopolitics* (2005), p. 8.

6. Brian Massumi, "Fear (the Spectrum Said)," *Positions* 13, no. 1 (2005): 34.

7. Kodwo Eshun, "Abducted by Audio," *Abstract Culture,* Swarm 3, Issue 12 (1997): Ccru, 12–13.

Chapter 14

1. Mark Bain, "The Live Room—Transducing Resonant Architecture" at http://framework.v2.nl/archive/archive/node/text/.xslt/nodenr-128820 (last viewed June 2, 2007).

2. See Mark Bain interview with Josephine Bosma (1999) at http://www.nettime.org/Lists-Archives/nettime-l-9908/msg00023.html.

3. Ibid.

4. "Interview with Mark Bain" by Molly Hankwitz and David Cox, January 3, 2000, Artists' Television Access, San Francisco, "qualifying this by noting that 'to a certain degree, developers and architects are terrorists in themselves . . . in the sense that most common people who live in the street or who live in these buildings don't have ownership on the properties, and so the decision to make buildings or to develop areas of cities or towns is really out of their hands.'" http://www.nettime.org/Lists-Archives/nettime-l-0007/msg00069.html (last viewed June 2, 2007).

5. "*The Live Room*—Transducing Resonant Architecture," *Organised Sound* 8 (2): 163–170. In his installation work, Bain seems to be aiming at a vibrational topology: "I'm trying to find a bridge between the two, between inhabitants of a structure and the structure itself. I am using a vibrational vehicle to connect them together." One of Bain's installation projects, *The Live Room,* was described as constructing "a topological space composed of virtual objects which haptically interface with the audience. By interacting with the cycling wave forms the visitor is occupied, infested with frequencies, modulated by vibrational energy and imparted with the volumetric sensibilities inherent within the body. The audience are the activated objects, traversing the site and feeling the liveliness of themselves, others and the space within." http://framework.v2.nl/archive/archive/node/text/.xslt/nodenr-128820 (last viewed June 2, 2007). See also M. Oliver, "The Day the Earth Screamed," February 13, 2004, http://arts.guardian.co.uk/features/story/0,,1147696,00.html.

6. J-F. Augoyard and H. Torgue, eds., *Sonic Experience: A Guide to Everyday Sounds,* trans. A. McCartney and D. Paquette. (Montreal: McGill-Queens University Press, 2005).

7. Mark Bain interview with Josephine Bosma.

8. Hans Jenny, *Cymatics: A Study of Wave Phenomena and Vibration* (Macromedia Publishing, 2001), pp. 96–97.

9. Note particularly, via sonic dominance, the transduction of bodily movement via dance.

10. Note the vibrational tendencies of flat panel speaker research. "As an example, the standard understanding of a 'loudspeaker' producing sonic waves has historically been constrained by the semiotic end of the continuum. Given the liberation of forces from such constraints allowed for by the military we find here that new avenues for sound are opened up in their direct interaction with human and nonhuman bodies. Flat panel speakers are a relatively recent technology in which dynamic surfaces are agitated to produce audio waveforms. This technology is currently being developed by weapons companies as a cladding surface for submarine vessels. If the waveform pumped out by the speakers can be generated at sufficient scale it can act both as a sound dampening technology and also as a means of repelling attacks by torpedo. As with contemporary musical aid ventures, sound acts directly to save lives. But more importantly, recognising the material effectiveness of media, without constraint to merely semiotic registers or the interminable compulsion to communicate allows media themselves to become fully expressive." Matt Fuller and Andrew Goffey, "Evil Media Studies" in *Spam Book,* ed. T. Sampson and J. Parikka (Cresskill, N.J.: Hampton Press, 2008).

11. The approach developed here sets up a parallel between bass and some of the ideas of architectural theorist Greg Lyn, especially his notion of the blob.

Chapter 15

1. It attempts to retain the exactness of concepts while leaving them vulnerable, open enough to resonate in unpredictable fashion outside of their home discipline. As Brian Massumi has argued, such an approach, for example, forces cultural studies to become vulnerable to the effects of scientific concepts, compelling change to the degree that culture is (as if it ever was not) subject to the forces of nature. He calls such a method, following Deleuze and Guattari, *machinic materialism. Machinic* designates not a technological fetishism but rather a preoccupation with rhythmic relation, process, connection, and trade. But it is also inflected by Baruch Spinoza's ethology, Alfred North Whitehead's process philosophy, and William James's pragmatist radical empiricism.

2. Kodwo Eshun, *More BrilliantThan the Sun* (London: Quartet, 1998), p. 004.

3. Ibid., p. 003.

4. B. Spinoza, *The Ethics* (Indianapolis, Ind.: Hackett, 1992).

Chapter 16

1. Gaston Bachelard, *The Dialectic of Duration* (Manchester, U.K.: Clinamen Press, 2000), p. 138. Bachelard goes on to describe how "rhythm is imprisoned in sound boxes. When we see a rhythm preserved in a radio aerial, we cannot stop the image of reciprocal action between the geometric and temporal from intruding into our thought. It is therefore in our interests to regard things as truly the products of stationary waves. Periods are spatio-temporal functions. They are the temporal face of material things. As it vibrates, a thought reveals both a temporal and a material structure.

"If we now add to this that periods are immediately translated into the language of frequencies and that frequencies appear as relative to one another, we see the absoluteness and the continuity of time not just fade but disappear. In any case, the continuity of absolute time that might serve as a basis for differentiating between periods is no longer the immediate continuity yielded by crude observation. The causality studied on the basis of frequencies is indeed in play above the continuity that is postulated as fundamental to duration of a period. In particular, the study of this causality through periods and frequencies could, in our view, be limited to statistics of periodic events. The regularity of an isolated vibration is postulated perfectly gratuitously, for in fact it is only the frequency of groups of vibrations that is used. Moreover, it must be noted that most phenomena which are explained by frequency are explained by a fairly large number of frequencies. The low periods of astronomy do not serve here as an explanatory motive. If the earth is considered as it moves in its orbit, it does not 'vibrate.' It follows its path. The time of astronomy is therefore not yet 'structured.' If we can consider the monotony of planetary motion, we can well understand how a uniform, continuous time came to be ascribed to it. It is precisely a time in which nothing happens. It is an inadequate schema for establishing the realism of rhythm.

"When we go deeply into the finely detailed forms of multiple causality, we become aware of the value of temporal organizations. We are less and less tempted to regard causes as just breaks in a general Becoming. These causes constitute wholes. They act as wholes, spanning useless intervals, without regard for images representing time as a flux whose entire force lies at its limits. Causal energy is not located on a causal wave font. The cause requires organic conventions. It has a temporal structure, a rhythmic action. It belongs to spatio-temporal structure.

"Alongside the cause's organic character and in connection with this character, we must also make way for the kaleidoscopic and discontinuous character of material change. Causal relations can thus gain in clarity when we study them from the arithmetical standpoint. There must be an advantage in arithmetising causality" (pp. 78–79).

2. Ibid., p. 137.

3. Ibid., p. 138.

4. Ibid., p. 127.

5. Ibid., p. 134.

6. Ibid., p. 144.

7. Ibid.

8. Ibid.

9. Henri Lefebvre, *Rhythmanalysis* (London: Continuum Press, 2004), p. 60.

10. Ibid., pp. 78–79.

11. Ibid., p. 67.

12. G. Bachelard, *Dialectic of Duration* (Manchester, U.K.: Clinamen Press, 2000), pp. 28–29.

13. Henri Bergson, *Matter and Memory* (New York: Zone, 1991), p. 208.

Chapter 17

1. Here marks the divergence between radical empiricism and the speculative realism of philosophers such as Graham Harman, who in *Guerilla Metaphysics* (Chicago: Open Court Publishing, 2007), specifically reacts against the emphasis on relation of Whiteheadian thought and the way in which is sacrifices the possibility of rigorous conception of the discrete, unrelated, "object."

2. Alfred North Whitehead, *Adventures in Ideas* (New York: Penguin, 1942), p. 172.

3. Ibid.

4. Ibid.

5. Ibid.

6. Ibid., p. 197.

Chapter 18

1. Alfred North Whitehead, *Process and Reality* (New York: Macmillan, 1929), p. 290.

2. This is a perspective that mathematicians such as Gregory Chaitin would certainly adhere to when they describe their work as "sensual mathematics."

3. Alfred North Whitehead, *Adventures of Ideas* (New York: Penguin, 1942), pp. 163, 166.

4. Ibid., p. 197.

5. Alfred North Whitehead, *Religion in the Making* (New York: Fordham University Press, 1996).

6. Whitehead, *Process and Reality,* pp. 102, 103.

Chapter 19

1. Alfred North Whitehead, *Process and Reality* (New York: Macmillan, 1929).

2. A body, in this sense, like affect, can be nonorganic or organic.

3. Gilles Deleuze, *Spinoza: Practical Philosophy* (San Francisco: City Lights, [1970] 1988), p. 128.

4. In his essay on acoustic cyberspace, Eric Davis critiques the detached, cerebral and visual model of cyberspace passed down from Descartes, developing an acoustic version in which the body is central, “Roots and Wires” (1997).

5 Baruch Spinoza, *The Ethics* (Indianapolis, Ind.: Hackett, 1992), p. 72.

6. P. Virilio, *Speed and Politics* (New York: Semiotexte, 1985).

7. Deleuze, *Spinoza,*, p. 123.

8. Ibid. Gilles Deleuze and F. Guattari, *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988), p. 381.

9. Ibid., p. 260.

10. Deleuze, *Spinoza,* p. 128.

11. Deleuze and Guattari, *A Thousand Plateaus,* pp. 256–257.

12. Ibid., p. 260.

13. Deleuze, *Spinoza,* pp. 127–128.

14. Deleuze and Guattari, *A Thousand Plateaus,* pp. 256–257.

15. Ibid.

Chapter 20

1. Michel Serres, *Genesis* (Ann Arbor: University of Michigan Press, 1997), pp. 52, 54.

2. Alongside René Girard’s cultural chaos theory of sacrifice, Serres‘s concept of noise provides the dynamic framework for much of Attali’s concept of noise. Serres’s concept

of turbulence, on the other hand, is equally crucial to Deleuze and Guattari's, and later De Landa's, dynamic notion of the war machine.

3. We can follow this Lucretian abstract vorticism vector through most of Serres's texts, from *Hermes* (Baltimore, Md.: Johns Hopkins University Press, 1984) and *The Parasite* (Minneapolis: University of Minnesota Press, 2007) through *The Birth of Physics* (Manchester, U.K.: Clinamen, 2001) to his later texts, *The Natural Contract* (Ann Arbor: University of Michigan Press, 1997) and *Genesis* (Ann Arbor: University of Michigan Press, 1997).

4. Lucretius, *On the Nature of the Universe* (London: Penguin, 1951), p. 66.

5. Gilles Deleuze, *The Logic of Sense* (London: Continuum, 2004), p. 306.

6. Serres, *Hermes,* p. 121.

7. Ibid., pp. 100–101.

8. War machines in this extended sense can therefore include configurations and consistencies in an array of populations, be they conceptual, molecular, bacterial, animal, commercial, artistic, meteorological, or passional. These war machines are not primarily concerned with resistance, and instead of taking violence as their primary object, they have a synthetic relation to aggression forced in encounters with obstacles that split speed into a space-time grid or apply a meter to an asymmetric rhythmicity, forcing a transversal spiraling movement into a barrier blockade of parallel channels. Metric apparatuses of security function through the modulation of turbulence and the control of its contagious trajectories, its escalative feedback gradients and tendencies to overflow. Yet with preemptive power, the power of the vortex is allied to control. Preemptive power produces spirals in time through the production of future-feedback circuits.

9. A war machine for Deleuze and Guattari can be constructed in any niche, and their deployment is certainly not restricted to the field of human culture.

10. Gilles Deleuze and Felix Guattari, *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988), pp. 361, 363.

Chapter 21

1. The document contextualized this device alongside two centuries of scientific research on the vortices that occur in nature, such as tornadoes, aircraft contrails, cigarette smoke, nuclear clouds, and waterspouts, from Helmholtz, better known as a pioneer of the physics of sound, to Kelvin in the nineteenth century, through to contemporary engineering research. Enhanced by numerical techniques and powerful computerized simulations, fueled by chaos and complexity theory, this research into the mechanisms and dynamics of formation, propagation, and stability of vortices has only intensified. Today the

simulation of turbulence continues this long-standing tangle of physics and engineering problems, relating to the behavior of systems "far from equilibrium," the emergence of order from chaos.

2. A thermocline, a concept relating to the distribution of temperatures in hydrodynamic situations, is a volatile layer or zone of transition between two relatively stable layers.

3. See G. Lucey and L. Jasper, "Vortex Ring Generators," in *Non-Lethal Defense* III, 2001 (note 2), Research report. U.S. Army, Adelphi.

4. In physics, predictability has conventionally been based on Newton's equations of motion. Given the forces, specific initial conditions lead to specific well-defined orbits in a corresponding coordinate phase space. Laminar flow implies predictable behavior in that stream lines that start off near each other remain near each other. Knowledge of motion at one point in the flow at one point in time implies knowledge of the motion at neighboring points in space and time. However, in the fluid dynamics of nonlinear systems, actual fluid movements exhibit both orderly and chaotic flows, with the nature of the flow changing from laminar to turbulent as some parameter or combination of parameters increases through some critical value. In turbulent motion, knowledge of the motion at one location at one time conveys nothing about the motion at nearby points at the same time or at the same point at later times, rendering prediction fundamentally impossible. Turbulence is treated as one of the grand challenges of high-performance computing. This is due to the massive complexity involved in simulating turbulent structures, where a flow behavior at the most molecular scales can produce disproportionate effects over large distances. Coveney and Highfield set out the problematic of turbulence simulation in physics whose nonlinear dynamics map onto the dynamics of security in the ecology of fear:

"Navier-Stokes equations describe the flow of continuous fluids; digital computers are inherently discrete, however, so they necessarily approximate these equations by dividing space and time into a grid and only take into account fluid behaviour at points on this grid. Thus, the computational fluid dynamicist faces a dilemma: if she subdivides space too far, then the time taken to obtain a solution to the equations will be prohibitively long because she has a very great number of points to consider; but if she settles for a cut-off that is too coarse, then she will omit important details that affect fluid behaviour such as eddy structures. In fact, the time taken to perform a fluid simulation increases as a high power of the Reynolds number, a measure of propensity for apparent mayhem of turbulence. [The dimensionless Reynolds number is defined as the ratio of the inertial to the viscous forces: the weaker the viscous forces, the greater the tendency to turbulence. At values of the Reynolds number of order 100, flows are usually laminar; at values of order 1,000,000, flows possess fully developed turbulence; intermediate values indicate the transition regime between the two states- the onset of turbulent motion.] At sufficiently high Reynolds values, the flow becomes turbulent and the Navier-Stokes equations are then a major headache to solve. Even though this is not, technically speaking, an intractable [NP] problem, for any reasonably sized problem on any existing computer it is

impossible to consider Reynolds numbers above around 10,000, a value corresponding merely to the onset of turbulence, rather than the fully developed form" (P. Coveney and R. Highfield, *Frontiers of Complexity* [London: Faber, 1991], p. 67).

It is all too common for the rhythms of global insecurity to be described using metaphors of disorder, and commotion. James Rosenau, in his *Turbulence in World Politics* (Princeton, N.J.: Princeton University Press, 1990), makes the case for "turbulence" as an analytical concept as opposed to merely a suggestive metaphor. Compelling as it may be, an analogical use of "turbulence" proves, he argues, only a hindrance to the enterprise of mapping outbreaks of war. A more rigorous alternative, Rosenau suggests, would be to ground the concept in the various branches of physics in which the sciences of turbulence have recently emerged and that recognize the omnipresence of turbulent dynamics across the continuum of the cosmos: Tennekes and J. L. Lumley remind us that "Most flows occurring in nature and in engineering applications are turbulent. The boundary layer in the earth's atmosphere is turbulent [except possibly in very stable condition]; jet streams in the upper troposphere are turbulent, cumulus clouds are in turbulent motion. The water currents below the surface of the ocean are turbulent; the Gulf Stream is a turbulent wall-jet kind of flow. The photosphere of the sun and the photosphere of similar stars are in turbulent motion; interstellar gas clouds . . . are turbulent; the wake of the earth in the solar wind is presumably a turbulent wake. Boundary layers growing on aircraft wings are turbulent. Most combustion processes involve turbulence and often even depend on it; the flow of natural gas and oil in pipelines is turbulent. Chemical engineers use turbulence to mix and homogenize fluid mixtures and to accelerate chemical reaction rates in liquids or gases. The flow of water in rivers and canals is turbulent; the wakes of ships, cars, submarines, and aircraft are in turbulent motion. The study of turbulence clearly is an interdisciplinary activity, which has a very wide range of applications. . . . [Furthermore,] many turbulent flows can be observed easily; watching cumulus clouds or the plume of a smokestack is not time wasted for a student of turbulence" (H. Tennekes and J. L. Lumley, *A First Course in Turbulence* (Cambridge, Mass.: : MIT Press, 1972, p. 1). The dynamics of turbulence, like rhythm more generally, can be abstracted out of research into liquid instabilities because "turbulence is not a feature of fluids [only] but of fluid flows [generally]" (Ibid., p. 3).

For Manuel De Landa, in his *War in the Age of Intelligent Machines* (New York: Zone, 1992), an abstract machine of turbulence transects a nature-culture continuum operating across an array of material instantiations. Alvin and Heidi Toffler in their book *War and Anti-War* (Boston: Little, Brown, 1983) argue that postmodern violence can best be understood through what they call its "Prigoginian" characteristics. In their seminal work *Order out of Chaos* Illya Prigogine and Isabelle Stengers theorize the active matter of systems "far from equilibrium," drawing out some of the implications of a conception of positive chaos, a patterning which does not just constitute the negative of order, but rather the emergent properties of dissipative structures, that is, turbulence. As they write in an oft-quoted moment, "For a long time turbulence was identified with disorder or noise. Today we know this is not the case. Indeed, while turbulent motion appears as irregular or chaotic on the macroscopic scale, it is, on the contrary, highly organized on the

microscopic scale. The multiple space and time scales involved in turbulence correspond to the coherent behaviour of millions and millions of molecules. Viewed in this way, the transition from laminar [i.e., nonturbulent or calm] flow to turbulence is a process of self-organization" (I. Prigogine and I. Stengers, *Order out of Chaos,* London: Flamingo, [1985] p. 41.

As H. L. Swinney and J. P. Gollub put it in *Hydrodynamic Instabilities and the Transition to Turbulence* (Berlin: Springer-Verlag, 1981), "Until recently, the practical definition [of turbulence] has been the appearance of apparent randomness in photographs of flows containing materials which permit visualisation of streamlines or other features. However, this approach omits the possibility of complex flow patterns that are nevertheless highly ordered" (p. 1). Indeed recent turbulence theory agrees that turbulence is not random, does not have infinite degrees of freedom, and is not merely "structureless meandering" but rather is "a well defined structure," an "order in the midst of chaotic motion." Trevor H. Moulden, "An Introduction to Turbulent Phenomena," in Walter Frost and Trevor H. Moulden, eds., *Handbook of Turbulence,* vol. 1, *Fundamentals and Applications* (New York: Plenum, 1977), pp. 25–26; Alexandre Chorin, "Lecture II: Theories of Turbulence," in A. Dodd and B. Eckmann, eds., *Lecture Notes in Mathematics: Turbulence Seminar, Berkeley 1976/1977* (Berlin: Springer-Verlag, 1977), p. 41. For a similar conclusion, see Trevor H. Moulden, Walter Frost, and Albert H. Garner, "The Complexity of Turbulent Fluid Motion," in Frost and Moulden, *Handbook of Turbulence* 1:3–4.

5. On this point, Canetti, *Crowds and Power* (New York: Penguin, 1984), is particularly insightful in his description of the rhythmic crowd through an analysis of the New Zealand Maori Haka, which while usually understood as purely a war dance, is actually a mode of collective expression of a wide range of affects.

6. Gilles Deleuze, *Difference and Repetition* (London: Continuum, 2004).

7. P. Turetsky, in "Rhythm: Assemblage and Event," in *Deleuze and Music,* ed. I. Buchanan (Edinburgh: University of Edinburgh Press, 2004), pp. 143–144.

Chapter 22

1. Gilles Deleuze, *Cinema 1* (London: Continuum, 2005), p. 77.

2. M. S. Howe, *Theory of Vortex Sound* (Cambridge: Cambridge University Press, 2003), p. 1.

3. Ibid., p. 1. Howe continues that "the sound generated by turbulence in an unbounded fluid is usually called aerodynamic sound. Most unsteady flows of technological interest are of high Reynolds number and turbulent, and the acoustic radiation is a very small by-product of the motion. The turbulence is usually produced by fluid motion over a solid boundary or by flow instability" (ibid., p. 25).

4. The concept of the rhythmachine should not be confused with the musical machinery for making beats, the drum machine, but rather refers to the algorithmic entities that organize music cultures from within.

5. L. Russolo, *The Art of Noises* (Hillsdale, N.Y.: Pendragon Press, 1986), p. 25.

6. Gilles Deleuze and F. Guattari, *A Thousand Plateaus,* trans. B. Massumi (London: Athlone, 1988). p. 364.

7. Oliver Messaien, *Music and Color—Conversations with Claude Samuel* (New York: Amadeus Press, 1994), p. 68.

8. Deleuze and Guattari, *A Thousand Plateaus,* p. 313. William McNeil explains, in *Keeping Together in Time* (Cambridge, Mass.: Harvard University Press, 1996), that the interface of war, rhythm, and discipline is complicated.

9. Chernoff, *African Rhythm, African Sensibility* , (Chicago: Chicago University Press, 1981).

10. Erik Davis, "Roots and Wires" (1997), http://www.techgnosis.com/cyberconf.html.

11. See, for example, S. Goodman, "Contagious Noise" in T. Sampson and J. Parikka, *Spam Book* (Cresskill, N.J.: Hampton Press, 2009).

12. See K. Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), for the Afrofuturist uptake of Paul Gilroy's conception of the Black Atlantic as diasporic network of cultural trade and transmutation.

13. See Simon Reynolds, *Energy Flash* (New York: Picador, 1997).

14. Camilo Rocha, "Global Ghettotech: fresh musics from a post-colonial world" at http://www.norient.com/html/show_article.php?ID=114. (2008)

Chapter 23

1. Brian Massumi, "The Superiority of the Analog," in *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002).

2. Pierre Levy, *Becoming Virtual: Reality in the Digital Age* (Perseus, 1998).

3. H. Bergson, *Creative Evolution,* trans. A. Mitchell (London: Macmillan, 1911), p. 322.

4. H. Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness,* trans. F. L. Pogson (New York: HarperCollins, 1960), p. 100.

5. Aden Evans, *Sound Ideas: Music, Machines and Experience* (Minneapolis: University of Minnesota Press, 2005), p. 68.

6. Ibid., p. 66.

7. Ibid., p. 64.

8. Ibid., p. 69.

9. Ibid., p. 70.

10. Massumi, *Parables for the Virtual,* p. 143.

11. Evans, *Sound Ideas,* p. 71.

12. Evans applies the concept of the surd to sound signal processing and defines it as "a discontinuity that represents the specificity, the unique moment of the original signal— . . .[ensuring] that no wholly accurate recreation is possible, that no analysis can do justice to the original signal" (p. 229). Such glitches force engineering to deal constructively with the problem, for example, the local intervention of the Lanczos sigma as a response to the Gibbs phenomenon. Aden Evans, "The Surd," in *Virtual Mathematics: The Logic of Difference,* ed. S. Duffy (Manchester, U.K.: Clinamen Press, 2004).

13. Evans, "The Surd."

14. Ibid., p. 231.

15. Massumi, *Parables for the Virtual,* p. 142.

16. See C. Roads, *Microsound* (Cambridge, Mass.: MIT Press, 2001), p. 55.

17. "Rhythm is perhaps the most primal of all things known to us. . . . Music is, by further analysis, pure rhythm; rhythm and nothing else, for the variation of pitch is the variation in rhythms of the individual notes, and harmony, the blending of these varied rhythms." Ezra Pound, 1910, quoted in ibid.

18. Philip Sherburne from *Clicks + Cuts 3* sleeve notes (2003).

19. K. Pohlmann, *Principles of Digital Audio* (Indianapolis, Ind.: Sams Publishing, 1992), pp. 21–22.

20. Ibid., p. 23. Pohlmann continues, "The theorem specifies that the sampling frequency must be at least twice the highest signal frequency. More specifically, audio signals containing frequencies between 0 and S/2 Hz can be exactly represented by S samples per second. . . . When the sampling theorem is applied to audio signals, the input audio signal is lowpass filtered, so that it is bandlimited with a frequency response that does not exceed the Nyquist (S/2) frequency. Ideally, the lowpass filter is designed so that the only signals removed are those high frequencies that lie above the high frequency limit of human hearing. . . . Consider a continuously changing analog function that has been sampled to create a series of pulses. The amplitude of each pulse, determined through quantization, ultimately yields a number that represents the signal amplitude at that

instant. To quantify the situation, we define the sampling frequency as the number of samples per second. Its reciprocal, sampling rate, defines the time between each sample. For example, a sampling frequency of 40,000 samples per second corresponds to a rate of 1/40,000 second. A quickly changing waveform—That is, one with higher frequencies—would require a higher sampling frequency. Thus, the digitalization system's sampling frequency determines the high frequency limit of the system. The choice of sampling frequency is thus one of the most important audio design criteria of a digitalization system, between it determines the audio bandwidth of the system" (pp. 22–25).

21. Roads, *Microsound*, pp. 57–60, and D. Gabor, "Acoustical Quanta and the Theory of Hearing" *Nature* 159 (4044), (1947): 591–594.

22. R. Mackay "Capitalism and Schizophrenia: Wildstyle in Effect," in *Deleuze and Philosophy: The Difference Engineer,* ed. K. Ansell Pearson (London: Routledge, 1997), p. 255.

23. Gregory Chaitin, *Conversations with a Mathematician: Math. Art, Science and the Limits of Reason* (Berlin: Springer-Verlag, 2001).

Chapter 24

1. Brian Eno famously makes the analogy between generative music and military strategy, pointing out, "I was quite fascinated by military strategy for a long while. I gave a talk about the difference between the traditional Western European army and the guerilla army. One of the things that I realized from that study was that, for a traditional army, every emergency was . . . an emergency. Every lump in the ground, every deviation from the right time of day or season for the battle, was an emergency. For the guerilla army, every emergency is an opportunity. Every bump in the ground is a place to hide. Every hole is a place to hide. Every spot of bad weather is a place where the regular army is going to get bogged down." Interviewed by Charles Amirkhanian in *Reality Hackers,* Winter 1988.

2. Michael Nyman, *Experimental Music* (Cambridge: Cambridge University Press, 1999).

3. David Toop, *Haunted Weather* (London: Serpents Tail, 2004), chap. 5.

4. Kodwo Eshun, "An Unidentified Audio Event Arrives from the Post-Computer Age," in *Longplayer,* ed. J. Finer (London: Artangel, 2001), p. 11.

5. E. R. Miranda, *Composing Music with Computers* (Burlington, Mass.: Focal Press, 2001).

6. See P. Todd, "Simulating the Evolution of Musical Behavior," in *The Origins of Music,* ed. N. L Walling, B. Merker, and S. Brown (Cambridge, Mass.: MIT Press, 2000); E. Bilotta, P. Pantano, and V. Talarico, "Synthetic Harmonies: An Approach to Musical

Semiosis by Means of Cellular Automata," in *Artificial Life VII Proceedings of the Seventh International Conference on Artificial Life* (Cambridge, Mass.: MIT Press, 2000).

7. Todd, "Simulating the Evolution of Musical Behavior," pp. 361–389.

8. Miranda, *Composing Music with Computers,* p. 119.

9. Miranda is particularly cautious of linear, progressive models of evolution: "Evolution is generally associated with the idea of the transition from an inferior species to an superior one and this alleged superiority can often be measured by means of fairly explicit and objective criteria: we believe, however, that this notion should be treated with caution. . . . With reference to prominently cultural phenomena, such as music, the notion of evolution surely cannot have exactly the same connotations as it does in natural history: biological and cultural evolution are therefore quite different domains. Cultural evolution should be taken here as the transition from one state of affairs to another, not necessarily associated with the notion of improvement. Cultural transition is normally accompanied by an increase in the systems' complexity, but note that 'complex' is not a synonym for 'better'" (ibid., p. 140).

10. C. Darwin, *The Origin of the Species* (London: Murrary, 1859). R. Dawkins, *The Blind Watchmaker* (London: Penguin, 1986).

11. Miranda, *Composing Music with Computers,* p. 131.

12. Ibid., p. 136.

13. Ibid., p. 145.

14. This idea combines the Musique Concrete notion of the sound object (Schaeffer) with the breakdown of semantic and causal modes of listening (Chion) and R. M. Shaffer's notion of schizophonia as sound object detached from its cause, and therefore unidentifiable. An audio virology explores the affect of such sounds. See *The Soundscape.* (Rochester, Vt.: Destiny Books, 1993).

15. Eshun, "An Unidentified Audio Event," p. 11.

Chapter 25

1. See, for example, in the field of media studies, Douglas Rushkoff's *Media Virus: Hidden Agendas in Popular Culture* (New York: Ballantine, 1996). In the field of marketing theory, a number of texts have explored the dynamics of hype in cultural virological terms, including Seth Godin's *Unleashing the Ideavirus* (New York: Simon & Schuster, , 2001), Malcolm Gladwell's *The Tipping Point: How Little Things Can Make a Big Difference* (New York: Back Bay Books, 2002), and Aaron Lynch's *Thought Contagion: How Ideas Act Like Viruses* (New York: Basic Books, 1998).

2. David Cronenberg, *Cronenberg on Cronenberg,* ed. C. Rodley (London: Faber and Faber, 1992), p. 82.

3. A typical definition of affective contagion within the sonic dimension has been outlined within developmental psychology. Daniel Stern outlines it as "automatic induction of an affect in one person from seeing or hearing someone else's affect display. This process may well be a basic biological tendency among highly evolved social species, which becomes perfected in man. The earliest affect contagion that has been demonstrated involves the human distress cry. Wolff found that two-month-old infants showed 'infectious crying' when they heard tape recordings of their own distress cries." Daniel Stern, *The Interpersonal World of the Infant* (New York: Basic Books, 1985), p. 143.

4. Back in those turbulent bubble days, June 1999 to be precise, during the height of the excitement over the insurgent potential of mp3, West Coast gangsta rapper Ice T participated in the second annual MP3 Summit in San Diego. Sitting on a panel examining the implications of the virulent and uncontrollable spread of digital music across the Internet, entitled "Music as a Virus: Biological Warfare," Ice placed his bets on the virus winning out against the corporation's autoimmune response of tightening copyright control. For a summary of proceedings, see http://www.ram.org/ramblings/philosophy/fmp/mp3_summit2_highlights.html and http://www.wired.com/news/culture/0,1284,20279–2,00.html.

5. On capitalism as composed by markets and antimarkets, see Fernard Braudel, *Civilization and Capitalism, 15th–18th Century: Structures of Everyday Life,* vol. 1 (New York: HarperCollins, 1981), and Manuel De Landa, "Markets and Anti-Markets in the World Economy" at http://www.t0.or.at/delanda/a-market.htm.

6. See Michael Nyman's *Experimental Music* (Cambridge: Cambridge University Press, 1999), for descriptions of some of the early adventures with indeterminacy in music.

7. The Human Genome Project has generated much basic DNA sequencing data, including virus codes and bacterial and protein sequences. Some digital sound design projects have sought to exploit such resources of data in order to generate musical parameters as a direct transposition of molecular parameters. The general idea is that DNA code dictates the particular configuration for the production of amino acids. The physicochemical instructions provide an evolutionary set of rules for sonic composition when fragments of DNA are transposed into, for example, MIDI events. One such example is the collaboration between artist John Dunn and biologist Mary Anne Clark, who collaborated on the sonification of protein data. The elaborate process of transcoding is described in an article at http://mitpress2.mit.edu/e-journals/Leonardo/isast/articles/lifemusic.html.

8. *Infection* is generally used here as synonym for *affection,* although clearly with an added sense of insidiousness. The target is close to rhythmic analyses of possession or, in Kodwo Eshun's terminology, abduction.

Chapter 26

1. According to the Elggren's sleeve notes, this article was written by Alexandra Mir in the *New York Daily News,* September 11, 2002.

2. A number of versions of the project's explanatory text were published in Slovenian, Norwegian, and Austrian newspapers in 2001, and the photographs that accompanied the project were exhibited in Finland and Norway.

3. The kind of device that would make possible such recordings are being researched. "There's a whole world down there," proclaimed scientist Flavio Noca at the Jet Propulsion Lab in California in 2001. In order to capture the sonic hydraulics of microcellular machinery, of swimming bacterium and viruses, a special "nanomicrophone" is being developed. Based around the principle of the stereocilia, the layers of tiny hairs that line the inner ear (as opposed to the membrane of the eardrum, which apparently gets too stiff as you attempt to miniaturize it), they are composed of billions of tiny filaments that respond to minute fluctuations of pressure. Noca noted that "in nature, membranes are present only as coupling devices between the acoustic environment and the zone, typically the cochlea, where the signal is picked up by stereocilia. Nature has evolved toward this solution, probably because of the unique properties of stereocilia at very small [submolecular] scales." Stereocilia are ubiquitous. Interestingly, even "nonhearing" animals (e.g., hydra, jellyfish, and sea anemones) possess them as early-warning, directional-pressure sensors. But it is the model of a fish's lateral line audition for prey detection, localization, and identification that most interests military researchers. See the interview between Alan Hall and Flavio Noca at http://www.businessweek.com/bwdaily/dnflash/jan2001/nf2001012_818.htm (last accessed June 3, 2005).

4. W. Burroughs, "Electronic Revolution," in *Word Virus: The William Burroughs Reader* (New York: Grove Press, 1999), p. 295.

5. Ibid., p. 301. In Neil Stephenson's cyberpunk novel, *Snow Crash* (New York: Bantam Spectra, 1992), the virus is able to smoothly shift between hacker brains, computer systems, and physiology via a drug. A recurrent Burroughs-type theme throughout Stephenson's book is the idea of language as a virus from an alien world.

6. The engram, as the "basic pathogenic building block" of Hubbard's system of dianetics, corresponded to a pathological version of the Socratic demon or independent internal voice or monologue. L. R. Hubbard, *Dianetics* (Austin, Tex.: New Era, 2003).

7. D. Schacter, *Forgotten Ideas, Neglected Pioneers: Richard Semon and the Story of Memory* (Hove, East Sussex, U.K.: Psychology Press, 2001).

8. Douglas Kahn, *Noise, Water, Meat* (Cambridge, Mass.: : MIT Press, 2001), pp. 313–214.

9. Richard Dawkins, *The Selfish Gene,* (Oxford Publishers, 1989).

10. Richard Dawkins, "Viruses of the Mind." at http://www.cscs.umich.edu/~crshalizi/Dawkins/viruses-of-the-mind.html, (1991).

11. Ibid.

12. Ibid.

13. A more sophisticated memetics that moves beyond Dawkins's almost religious scientism is developed by Robert Aunger who tries to discard with the hardware model of human memory, which often seems implicit to many memetic approaches. In *The Electric Meme* (New York: Simon and Schuster, 2002), Aunger argued that memes were essentially a specific subspecies of memory. He compares the movement of memes with the movement of information patterns through the brain; when a particular skill becomes embedded as habit, "a meme may migrate through the brain as it goes from being a sensory stimulus to a short term then a long term memory"(p. 213). For Aunger, the birth of memory involved the emergence of a set of specialized neurons that, opposed to receptor and motor neurons, would fire only on certain types of input fed to them from other neurons; these were in a sense "interneurons," or connectors (p. 179). He maintained that memories were distributed across neural networks and were therefore always relational. The exact process of this distributed memory storage was thought to vary most importantly between long-term and short-term memory and went straight to the heart of the primary raison d'être of memetics: the autonomy of cultural evolution from biological evolution and, in fact, culture's ability to adapt biology. Memetics attempted to break with the dominance of genetics, which had repelled cultural studies from most other varieties of social Darwinism.

Crucial to understanding the varying functions of memory, Aunger maintained that the "primary difference between short-term and long-term memory is therefore the direct involvement of genes" (p. 190). These memories were thought to be stored as variations in synaptic connections between neurons. These changes in the topology of the network could occur because new cells (networked nodes) or new connections between existing cells were added, thereby adjusting the physical wiring of the brain in relation to feedback from the environment. Requiring new cells or parts of cells, these storage systems related to more long-term memories. Finally, the plasticity of the synapses, that is, the microtemporally varying strength of the synaptic connections themselves, were thought to relate more closely with short-term memory, which, as Aunger argued, functions "independent of new protein synthesis" (p. 190), and therefore defined a zone of relative autonomy from genetic interference.

14. In "Viruses of the Mind" Dawkins's major polemic is against irrational belief systems, specifically religions. When describing the symptoms someone would display if infected by a thought contagion, he notes their irrational, faith-based convictions, their intolerance to rival memes, and their lack of interest in factual evidence that might undermine their belief system into question. "Scientific ideas, like all memes, are subject to a kind of natural selection, and might look superficially virus-like. But the selective forces that

scrutinize scientific ideas are not arbitrary and capricious. They are exacting, well-honed rules, and they do not favour pointless self-serving. They favour all the virtues laid out in textbooks of standard methodology: testability, evidential support, precision, quantifiability, consistency, intersubjectivity, repeatability, universality, progressiveness, independence of cultural milieu. . . . For scientific belief, epidemiology merely comes along afterwards and describes the history of its acceptance."

15. Manuel De Landa, *One Thousand Years of Nonlinear History* (New York: Zone, 2000).

16. See, for example, Antonio Damasio's development of anti-Cartesian neuroscience in *The Feeling of What Happens* (New York: Vintage, 1999).

17. See Gabriel Tarde, *Laws of Imitation* (New York: Holt, 1903), and P. Marsden's "Forefathers of Memetics: Gabriel Tarde and the Laws of Imitation," http://cfpm.org/jom-emit/2000/vol4/marsden_p. html, 2000.

Chapter 27

1. One online community has set up a users' group for those suffering from earworm infection: http://www.livejournal.com/community/earworm/. One member of that community has formulated a species analysis of the worms, dubbing them "mematoda": "Invertebrates of the phylum Mematoda vary wildly in appearance. Sometimes measuring several stanzas long, there seem to be two distinct types of average earworm anatomy: divided into four sections of four (although I have occasionally come across three segments of four, and once an unprecedented Madison, be wary of the IDM earworms for extraction seems to be nearly impossible, or completely smooth unsegmented cylindrical bodies, often narrowing at each end, where mouthparts and organs of aspiration are located). Earworms possess the power of regeneration seen in their soil bound counterparts. Located on the sides of most Mematodes are several hundred tiny 'hooks' that aid in locomotion (swing your hips now). Color and texture tend to vary wildly from worm to worm, but sexing an earworm is surprisingly simple; as they appear to be almost exclusively asexual, and reproduce primarily via karyokinesis . . . (karaoke). . . . Since sexual reproduction is almost unknown among earworms, the standard earworm is a solitary organism by both nature and choice . . . and gorges itself on its host's misspent potential for productive thought. . . . Gestation is nonexistent and generation almost instantaneous. The average earworm will utilize its host to assist with reproduction. Mitosis occurs almost immediately upon communication and the young demur unconditionally to their parent. The process of division secretes a slow acting enzyme that eventually seizes the host with an uncontrollable urge (I want to tell you all about it) to sing, hum, or otherwise vocalize the earworm's genetic material. . . . The (almost identical, barring mutation) copies are propelled from the host to other unsuspecting persons. If not ejected from the host soon, the young inevitably become part of the earworm's supplemental diet (for full maturation seems to be impossible with an older, identical earworm pres-

ent). . . . Parthenogenesis (no one move a muscle as the dead come home) has also been known to occur on the airwaves of the radio, but reports of spontaneous earworms have been attributed to virtually any arrangement of sonic vibrations in time that produce a continuous, unified, and evocative composition, as through melody, harmony, rhythm and timbre. Rarely are earworms read, but it has been reported. . . . Blatant, unapologetic, parasites, earworms dwell primarily in the brains of their hapless human hosts. But luckily, without a steady stream of conscious thoughts to feed on, the lifespan of an earworm without a host is only a few frantic moments (typically around four minutes, thirty three seconds). However, as anyone who has ever acquired an earworm can attest, once a earworm is suitably situated in a host, its lifespan increases exponentially." http://www.livejournal.com/users/ktrey/36492.html.

2. Tom Vague, "Interview with Klaus Maeck," *Vague,* 16/17 (1984): 65.

3. William Burroughs, "Electronic Revolution," in *Word Virus: The William Burroughs Reader* (New York: Grove Press, 1999). Elggren, *Virulent Images, Virulent Sounds,*

4. The military origins of Muzak derive from scientist, researcher, and inventor George Own Squier. See Joseph Lanza, *Elevator Music: A Surreal History of Muzak, Easy-Listening, and Other Moodsong* (New York: St. Martin's Press, 1995), and Robert Sumrell and Kazys Varnelis, *Blue Monday: Stories of Absurd Realities and Natural Philosophies* (New York: Actar, 2007).

5. Annahid Kassabian, "Ubisub: Ubiquitous Listening and Networked Subjectivity," *ECHO* 3, no. 2 (Fall 2001) .

6. Jean-François Augoyard and Henri Torgue, *Sonic Experience: A Guide to Everyday Sounds* (Montreal: McGill-Queens University Press, 2005), p. 130.

7. A company called QinetiQ has been developing NXT flat panel speak technology, based on military research, drawing on the vibrational potential of all surfaces. See the press release at http://www.qinetiq.com/home/newsroom/news_releases_homepage/2004/2nd_quarter/_Your_captain_speaking__QinetiQ_makes_aircraft_cabin_announcements_clearer_and_crisper.html (last viewed on Sept. 15, 2007).

8. See, for example, http://www.muzakoftoledo.com/index.html.

9. The Taylorist Hawthorne effect described the effect of an environmental change in a work setting to stimulate a short-term increase of workers' productivity due to the feeling that management was changing or monitoring it. The effect was named after productivity experiments conducted in the 1920s on telephone factory workers at Western Electric's Hawthorne Plant in Chicago.

10. William James argued that we feel emotions due to a change in the physiological state of our bodies, as opposed to the inverse. This idea, developed in parallel by Carl Lange, supported the idea that by affecting the body physiologically, background music could assist in keeping workers calm, and so make them more emotionally stable during the trials

of war. William James, *The Principles of Psychology* (New York: Dover, 1890). The James–Lange theory of emotion contrasts with the more neurally mediated one developed by Walter Canon in "The James-Lange Theory of Emotion: A Critical Examination and an Alternative Theory," *American Journal of Psychology* 39 (1927): 106–124.

11. Sumrell and Varnelis, *Blue Monday,* p. 126.

12. Michael Peters quoted in C. Dowdy, "Sonic Mnemonic," *Financial Time,* January 30, 2001, IT Creative Business Section, p. 7,

13. See James J. Kellaris, "Dissecting Earworms: Further Evidence on the 'Song-Stuck-in-*Your*-Head' Phenomenon," in *Proceedings of the Society for Consumer Psychology,* ed. Christine Page and Steve Posavac ((New Orleans: American Psychological Society, 2003), pp. 220–222.

14. The contagiousness of these audio viruses operates on a mass scale compared with the rarefied domains of sound art and generative or algorithmic sound design, which tend to still assume an ambient aesthetic. We can only speculative on their convergence.

15. Kodwo Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), p. 143.

16. See "When Branding Works" at http://www.dunningsprague.com/articles/branding.htm (last viewed February 25, 2006).

17. A sonic logo, or aural trademark is a small nugget of sound lasting between 2.5 and 4 seconds. Sonic brands tend to be modular and fit into "templates" that dictate where to position a sonic logo or where to use a voice over. Into the concentrated sonic logo is nested what are known as earcons (a sonic version of an icon), which may be used for particular buttons on, for example, a brand's Web site. The sonic logo can be elaborated into a complete piece of music. Sonic branding also issues a set of protocols for engineering the voice, known as "speech fonts," which are algorithms for selecting the right voices for brand communications.

Chapter 28

1. E. Gobé, *Emotional Branding* (Oxford: Windsor Books, 2003), p. 71.

2. Kodwo Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), p. 180.

3. Gilles Deleuze, *Bergsonism* (New York: Zone, 1991), p. 57.

4. Ibid., p. 60.

5. Jean-François Augoyard and Henri Torgue, *Sonic Experience: A Guide to Everyday Sounds* (Montreal: McGill-Queens University Press, 2005), p. 21.

6. Ibid., p. 85.

7. A. N. Whitehead, *Adventures of Ideas* (New York: Free Press, 1993), p. 192.

8. Ibid., p. 186.

9. Ibid., p. 188.

10. Ibid., p. 215.

Chapter 29

1. Barbara Browning's *Infectious Rhythms,* while limited in its representational methodology, maps the symbiotic relationship between migration and the virulent spread of the AIDS virus through the African Diaspora. The text issues a useful cautionary note to an audio virology regarding the racialized connotations of virological discourse. While this book acknowledges such dangers, it is careful to investigate the sense in which we can talk about contagious cultural processes underneath the level of representations, significations, and unproblematized identities caught in the essentialist-antiessentialist binary that Gilroy's Black Atlantic dismantles.

2. In his "2 Steps Back" article in *The Wire,* 166 (1997) Simon Reynolds noted how a number of breakbeat scientists understood their production processes as a sonic parallel to "gene splicers designing viral pathogens for biological warfare."

3. See the sleeve notes of *Interstellar Fugitives.*

4. See Frank Gunderson "Applying Memetics to the Historical Understanding of the African Diasporan Music Culture of North America," 2001, http://www.ohiou.edu/aas/blackpraxis/articles/frank.html.

5. Ibid.

6. Ibid.

7. Eshun, *More Brilliant Than the Sun,* p. 002.

8. Kodwo Eshun and Edward George, "Ghostlines: Migration, Morphology, Mutations," in *Sonic Process* (Barcelona: Barcelona Museum of Contemporary Art, 2003).

9. Steve Barrow, "Version Therapy," *Wire,* no. 132 (February 1995): 28–31.

10. On the mutations of the dub virus connecting the dub scientists of Kingston to early 1980s post-punk, Berlin dub techno and UK jungleism see Eshun and George, "Ghostlines."

11. See the sleeve notes to Kevin Martin's *Macro Dub Infection.*

12. From "Roots in the Music" on Prezident Brown—CD 2—Prezident Selections.

13. Gunderson, "Applying Memetics."

14. Formerly archived at http://www.hyperdub.com/softwar/ukgarage.cfm (2002).

15. Ian Penman, "KLANG! Garvey's Ghost Meets Heidegger's Geist," in *Experiencing the Soundtrack: Cinesonic 3,* ed. P. Brophy (Sydney: Allen and Unwin, 2001), p. 107.

16. "Dub's sub-sonic echo is no mere FX—it is the effect proper of a certain subjective view of the world: the dark sonic mirror reflection of Rasta's phantasmal worldview. Dub versions are the shavings of(f) the certainty of (Western) technology as the unmediated reproduction of a singer's performance. Dub was a breakthrough because the seam of its recording was turned inside out for us to hear and exult in. We had previously been used to the 're' recording being repressed, recessed, as through it really were just a re-presentation of something that already existed in its own right. Dub messes big time with such notions of uncorrupted temporality. Wearing a dubble face, neither future nor past, dub is simultaneously a past and future trace: of music as both memory or futurity, authentic emotion and technological pragmatism. Dub's tricknology is a form of magic which does indeed make people disappear, leaving behind only their context, their trace, their outline (Where does the singer's voice go when it is erased from the dub track?) It makes of the voice not a self-possession but a dispossession—a 're' possession by the studio, detoured through the hidden circuits of the recording console." I. Penman, "Black Secret Tricknology," *Wire,* no. 133 (March 1995). Later, Penman takes his dub theory further: "We inhabit a dub world now . . . a dub economy: a writing of echoes, alternative versions, negative traces . . . displacement and omission, quotation and stress; what have previously been considered the mere framing devices of Production and Mix become, through dub, the means for unsettling new emphases. Dub breaks with tradition. Dub breaks—intentionally, internally, massively—the tradition of Tradition. Dub wreaks havoc, multiplying echoes. . . . Layered ambivalence of its echowerk: how can we set store by any memorial overview once we know a ghost is loose in our ears? . . . Double economy of dub: agonal reverberation of that which opens><closes according to its phantasmal logic. Dub as simultaneously either-or, neither-nor; a double enunciation which unsettles such implicit assumptions as: local><universal; sacred><secular; black><white; urban><pastoral; archaic><modern; analogue><digital; Muzak><wakeup call; natural><artificial; roots><technology; homeland><exile." Ibid., p. 107.

17. Ibid., pp. 106–107.

18. Peter Manuel and Wayne Marshall, "The Riddim Method: Aesthetics, Practice, and Ownership in Jamaican Dancehall," *Popular Music* 25, no. 3 (2006).

19. Digital music was being produced in Jamaica from the early 1980s onward (e.g., Prince Jazzbo productions and Horace Ferguson's Sensi Addict).

20. A short list of the viral spread of the amen funk break as DNA of hip-hop and jungle may track the migration of this drum pattern from the flip side to the Winstons' 1969 top

10 soul hit “Color Him Father” into turbulent breakbeat science of producers like Remarc via the likes of 2 Live Crew’s “Feel Alright Yall,” 3rd Bass’s “Wordz of Wisdom,” 4 Hero’s “Escape That,” Amon Tobin’s “Nightlife,” Aphex Twin’s “Boy/Girl Song,” Atari Teenage Riot’s “Burn Berlin Burn,” Brand Nubian’s “The Godz Must Be Crazy,” Deee-Lite’s “Come on In, the Dreams Are Fine,” Dillinja’s “The Angels Fell,” Eric B and Rakim’s “Casualties of War,” Funky Technicians’s “Airtight,” Heavy D’s “Flexin,” Heavy D’s “MC Heavy D!” Heavy D’s “Let It Flow,” Heavyweight’s “Oh Gosh,” J. Majik’s “Arabian Nights,” J. Majik’s “Your Sound,” Lemon D’s “This Is Los Angeles,” Level Vibes’s “Beauty and the Beast,” Lifer’s Group’s “Jack U. Back (So You Wanna Be a Gangsta),” Ltj Bukem’s “Music,” Mantronix’s “King of the Beats,” Movement Ex’s “KK Punani,” Nice and Smooth’s “Dope Not Hype,” NWA’s “Straight Outta Compton,” and Schoolly D’s “How a Black Man Feels,” http://hubpages.com/hub/Samples-and-Breakbeats-A-Funky-Soul-DJ-Demonstration-Video-Part-9.

21. See Simon Reynolds, *Energy Flash* (London: Picador), p. xviii.

Chapter 30

1. Simon Reynolds, “Back to the Roots,” *Wire,* no. 1999 (September 2000): 35. It is crucial that the polemical context of the Reynolds argument be recognized, especially since a large part of his own oeuvre in the past fifteen years has been devoted to the rapture of dancer, producer, DJ-centered worlds of electronic dance music in which a parallel denigration of human musician and singers occurs. On the other hand, the article is also characteristic of another of Reynolds’s traits, a return to his own specific brand of inverse sono-political correctness, which tends to be attached to various combinations of black, proletarian, and femininist movements within music, sometimes at the expense of and sometimes coupled to futurism. There is therefore a fascinating tension between tendencies in Reynolds’s writing and that of Eshun.

2. Ibid., p. 36.

3. Ibid.

4. Actually this is quite a bizarre argument considering that the bulk of the reception of reggae music in the Western world had revolved around biographies of Bob Marley and the intersection of his biographies with the overt politics of his music. It can only be assumed that Reynolds, as is his tendency, was aiming the argument particularly at the theoretically informed music journalism typical of *Wire*-related theorists such as David Toop and Kodwo Eshun, and the tendency of that magazine to focus on dub over roots reggae. Interestingly, this argument has much broader resonances, as Reynolds points out later in the article, as it extends to a general preference for instrumental over vocal music in the sound system diaspora, from dub over reggae, to drum’n’bass over jungle, dubstep over vocal 2step and grime. A repeated theme in Reynolds’s work seems to hang around an observation that there is a racialized politics of taste involved in the Western world’s

reception of the musical black voice. In an earlier essay, I sought to move beyond the opposition between Reynolds's emphases and those of Afrofuturism. See S. Goodman, "Speed Tribes: Netwar, Affective Hacking and the Audio-Social," in *Cultural Hacking,* ed. F. Liebl (Berlin: Springer-Verlag, 2004).

5. Such an attempt in fact seems to encapsulate the multiplicity of voices contained under the umbrella of Afrofuturism, but particularly draws attention to the singularity of perspective of Kodwo Eshun's writings and what differentiates his conceptualizations from, in particular, Afrrican American cultural studies, from Weheliye to Nelson, but also the Afrofuturism of Paul Miller/DJ Spooky. It could be argued that U.S. Afrofuturism is shaped by a very peculiar nexus of black urban experience that is significantly divergent from that of the U.K. In musical terms, it would seem that part of this divergence revolves around the sonic singularity in the U.K., the event of jungle/drum'n'bass in the mid-1990s that seemed to catalyze one of the core innovations of Eshun's text, the futurerhythmachine.

6. A. Weheliye, "Feenin: Posthuman Voices in Contemporary Black Popular Music," *Social Text* 20, no. 2 (Summer 2002), and *Phonographies: Grooves in Afro-Sonic Modernity* (Durham, N.C.: Duke University Press, 2005).

7. F. Kittler, *Gramophone, Film, Typewriter,* trans. G. Winthrop-Young and M. Wutz (Stanford, Calif.: Stanford University Press, 1999, p. 49).

8. Ibid., p. 63.

9. Weheliye, "Feenin," 38.

10. Ibid., p. 22.

11. Weheliye also interestingly points to the "spirituals" as weapons for both white and black abolitionists in a sonic war against American slavery.

12. Kodwo Eshun, *More Brilliant Than the Sun* (London: Quartet, 1998), pp. 192–193.

13. Weheliye, "Feenin," p. 30.

14. Eshun, *More Brilliant Than the Sun,* p. 6.

15. Kodwo Eshun, "The Kinematic Pneumacosm of Hype Williams: The Rhythm of Vision Is a Dancer," in *Cinesonic 3: Experiencing the Soundtrack,* ed. P. Broophy (Sidney: AFTRS Publications, 2001), pp. 51–58.

16. Kodwo Eshun, "Further Considerations on Afrofuturism," *CR: the New Centennial Review* 3, no. 2 (Summer 2003).

17. Weheliye, "Feenin," p. 30.

18. Reynolds, "Back to the Roots," p. 36.

Chapter 31

1. Mike Davis, *Planet of Slums* (London: Verso Press, 2005).

2. Mike Davis, *The Ecology of Fear: Los Angeles and the Imagination of Disaster* (New York: Picador, 1998), p. 422.

3. M. Davis, "Planet of Slums," *New Left Review* 26 March–April 2004), http://newleftreview.org/A2496.

4. Ibid.

5. H. De Soto, *The Mystery of Capital* (New York: Bantam Press, 2000).

6. M. McLuhan, *Understanding Media* (Cambridge, Mass.: MIT Press, 1994).

7. Davis, "Planet of Slums," p. 14.

8. The early funk parties were know as baile funk de briga, in other words, fighting funk dances. As Neate and Platt describe, "In the late 1990s, baile funk was particularly notorious for outbreaks of violence between rival gangs. These were no typical brawls, however, but ritualized fights that were carefully orchestrated by the promoters using hired security to separate the different galeras into two sides. . . . The DJ would put on different tracks to stoke up the atmosphere and, with each track he played, the atmosphere got a little more rowdy. Then fighting would break out, with the guys at the front punching and kicking the hell out of each other. The security guards would let this go ahead but then, at a certain point, they'd hit us with truncheons to get us to stop. All the funeiros would obey." P. Neate and D. Platt, *Culture Is Our Weapon: Afroreggae in the Favelas of Rio* (London: Latin American Bureau, 2007), p. 53.

Robert Neuwirth describes his visit to a typical funk party in Rio de Janeiro: "At the end of my first day in Ricinha, Paul Sneed, who brought me into the community and lived in the flat next door to mine, took me down the hill to the baile funk: an all-night dance party. Many favelas have them, usually on the weekends. Rocinha's baile took place every Friday night in the Valao. We took a series of becos that brought us to the bottom of the hill in what seemed to me to be record time. The becos were quite active and several bars—little more than counters set into the ground floor of buildings, with stools set up on the lip of the pathway—were hopping. In the valao, a disc jockey had set up a wall of 50 speaker boxes alongside the 10 foot wide channel of open sewage that ran down the neighbourhood's main drag and that gave the area its name. He was spinning aggressive, assault-your-ears rap and hip hop. Although it was past midnight, it was still early for the baile. Hundreds of people were milling about. Three girls who must have been 13 or 14 were doing synchronized dance steps at one end of the line of speakers. They had synchronized their outfits, too: white hotpants and glittery, gold strapless tube tops. Some younger boys had perched inside the speaker boxes and were simply sitting there, banging to the beat, and no doubt, damaging their ear drums. More of the stores were

open. And why not: it was too loud to sleep and the party would continue until dawn. Far better to get some money out of the deal. Competing with the free baile was a nightclub. Emocoes, located in a Spartan cement structure along the Estra da Gavea that seemed like it might have been built as a parking garage. There, the loud rap sounds echoed off the concrete. Entry was by paid admission—R$5 (about $2)- and although women were let in with no trouble, any man entering was frisked by the sturdy bouncers. The frisk finished with a quick squeeze of the testicles, to ensure no one had a concealed weapon. It was crowded and humid inside. People pressed forward to dance or hung at the back, where there was a makeshift bar. Here caipirinhas sold for less than a buck, and there seemed to be no check at all on underage drinking. Rocinha has lots of these kinds of parties, they were magnets for thousands of teenagers who lived in the community. Twice a month, Beer Pizza sponsored a massive free dance party. . . . All across the favelas, few people listened to the music that outsiders think of as Brazilian. Everyone knows the samba, bossa nova, and Musica Popular Brasileira (MPB) hits. They're the soundtrack of the telenovelas—TV soap operas- and the ever-present background of everyday life. But the mass of favela dwellers have embraced hardcore rap and funk (what Brazilians call funk is akin to what Americans know as hip hop) as their emblematic sound. This music can be raunchier than the West Coast variety that carries parental advisory labels in the US, and is often blasting from various places in the favela at incredibly high volume." *Shadow Cities* (London: Routledge), pp. 38–39.

9. Matt Ingram, blog post, 27/06/2004 at http://www.woebot.com/movabletype/archives/000850.html.

10. Simon Reynolds, "Piracy Funds What?" *Village Voice,* February 15, 2005, http://www.villagevoice.com/music/0508,reynolds,61282,22.html.

11. It is useful here to bear in mind the Afrofuturist critique of the stereotyped notion of black music that ties it rigidly to the "street," the "ghetto," and superficial notions of "realism."

12. Neate and Platt, *Culture Is Our Weapon,* p. 48.

13. Ibid., p. 51.

14. Ibid., p. 52. They further note that "there is also a popular sub-genre of the music called funk probido or proidbiao—prohibited funk—that eulogises the drug factions, violence and criminality in general" and in which rappers will "denigrate the police and promote a particular faction" (pp. 52–53).

15. "Funk could be the colour of the city, the biggest generator of employment. It would achieve much more than the government does with all its endless projects, projects and more projects. Afroreggae works and is something that was born independently. With the mass movement behind it, if funk got organized, set up an NGO and took action inside the community, it would be the most powerful NGO in Rio." Ibid., pp. 55.

Chapter 32

1. Simon Reynolds, *Energy Flash* (New York: Picador, 1998), p. 231.

2. M. Fuller, *Media Ecologies* (Cambridge, Mass.: MIT Press, 2005),, p. 50.

3. See http://www.ofcom.org.uk/media/news/2005/11/illegal#content for recent anti-viral activities.

4. See Govil in the *Sarai Reader,* 2004, p. 378, available at www.sarai.net.

5. G. Bachelard, "Reverie and Radio," in Radiotexte, ed. N. Strauss (New York: Semiotexte, 1993), p. 219.

6. Fuller, *Media Ecologies,* pp. 29–31.

7. A key site of pirate listening is often in low-frequency intensified car sound stereos. See Brandon LaBelle, "Pump Up the Bass—Rhythm, Cars, and Auditory Scaffolding," *Senses and Society* 3, no. 2 (2008): 187–204.

8. B. Sterling, "The Sham Economy," *Wired* 13 (March 2003).

9. Reynolds, *Energy Flash,* p. 230.

10. In the U.K., an interesting case study is the publicly funded digital channel BBC1extra (http://www.bbc.co.uk/1extra) in which, simultaneously, underground music cultures are incorporated into/infect the body of state-sponsored media. Contemporary capitalism is driven by the very tension between formal licensing structures and informal pirate radio markets.

11. M. Mason, *The Pirate's Dilemma: How Youth Culture Is Reinventing Capitalism* (New York: Free Press, 2008).

12. "Pirates have been the architects of new societies for centuries: they have established new genres of film and music and created new types of media, often operating anonymously and always—initially at least—outside the law. They overthrow governments, birth new industries, and win wars. Pirates create positive social and economic changes, and understanding piracy today is more important than ever, because now that we can all copy and broadcast whatever we want, we can all become pirates." Ibid., p. 35.

13. Ibid., pp. 43–44.

14. Ibid., pp. 46–47. "When push comes to shove, copyrights PREVENT a lot of new culture, and patents PREVENT a lot of innovation" (p. 56). As Mason continues, "Entrepreneurs look for gaps in the market. Pirates look for gaps outside the market . . . pirates have proved that just because the market won't do something, it doesn't mean it's a bad idea. . . . Once pirates find a space the market has ignored, they park a new vehicle

in it and begin transmitting. Sometimes this new vehicle becomes more important. . . . When pirates do something valuable in society, citizens support them, discussion starts, and laws change" (p. 66). Mason continues: "People, firms and governments are being forced to do the right thing by a new breed of rebels using a cutthroat style of competition, which combines both their self-interest and the good of the community" (p. 239). And yet, he argues, they "are taking over the good ship capitalism, but they're not here to sink it. Instead they will plug the holes, keep it afloat, and propel it forward" (p. 239). So, for Mason, "Punk capitalism isn't about big government or big markets but about a new breed of incredibly efficient networks. This is not digital communism, this isn't central planning. It is quite possibly the opposite: a new kind of decentralized democracy made possible by changes in technology. Piracy isn't just another business model, its one of the greatest business models we have. . . . Acting like a pirate—taking value from the market and giving it back to the community" (p. 240). Instead, he concludes, piracy "transforms the markets it operates in changing the way distribution works and forcing companies to be more competitive and innovative. Pirates don't just defend the public domain from corporate control; they also force big business and government to deliver what we want, when we want it" (p. 38). The ambivalence of Mason's argument should now be clear: what was radical about youth culture becomes taught in business schools as sensible strategy, and the loop between underground cultural innovation and mass marketing tightens and tightens to the point where capitalism begins to preempt innovation via cool hunters and viral branding.

Chapter 33

1. "The Mosquito has given us excellent results. We sited the equipment in the Coach parking section of one of our Multi-Storey car parks. A local hotelier has continually complained over a period of at least two years about the constant problems of youths on skateboards, BMX bikes etc. in this area. We used to have to attend site at least six times a day during the school holidays. We even went to the extent of bringing in a private security firm to permanently cover the evenings and holiday afternoons, however due to budget restrictions this has now been ceased. The hotelier went as far as reporting us to the HSE due to the risk of injury to the youths from their behaviour. As you can imagine, this has cost us tens of thousands of pounds over the last two years in staffing and remedial works to move on the youths. . . . Since installing the Mosquito, the reduction in the number of incidents reported to us has dramatically reduced. We even received an email from our number one complainant stating that he had experienced the quietist holiday period ever. The only problem is that the youths have moved on and are now causing trouble elsewhere! Make arrangements for its return, never. Just send me an invoice for this one and hopefully, next financial year, I shall be placing orders for additional units." Rob Harmes, senior parking operations inspector, Mosquito press release. http://www.compoundsecurity.co.uk/.

2. Tsutomu Oohashi et al., "Inaudible High Frequency Sounds Affect Brain Activity: Hypersonic Effect," *Journal of Neurophysiology* 83 (2000): 3548–3558.

3. Super Audio format CDs and DVD audio have frequency ranges that go up to 100 and 96 kilohertz, respectively.

4. Alpha waves are electromagnetic oscillations in the frequency range of 8 to 12 hertz arising from rhythmic electrical pattern in the human brain.

5. S. Treister, *Hexen 2039: New Military Occult Technologies for Psychological Warfare* (London: Black Dog, 2006). Treister's earlier work was situated as part of a loose collection of artists referred to, particularly in the mid-1990s, as cyberfeminist, (re-)installing women, or femininity as protagonist within cybernetic culture. See, for example, Jyanni Steffensen, "Doing It Digitally: Rosalind Brodsky and the Art of Virtual Female Subjectivity," pp. 209–233, in *Reload: Rethinking Women and Cyberculture,* ed. M. Flanagan and Austin Booth (Cambridge, Mass.: MIT Press, 2002). Steffensen's cyberfeminist and psychoanalytic reading analyzes Treister's earlier project, No Other Symptoms: Time Travelling, with Rosalind Brodsky in which Brodsky travels back in time to try to save her parents from the Holocaust.

6. U.S. patent 5,159,703.

7. Jon Ronson, *The Men Who Stare at Goats* (New York: Picador, 2004), p. 191.

8. The two best-known implementations of directional ultrasound technology are known as the Audio Spotlight made by the Holosonic Research Labs and the Hypersonic Sound Device made by American Technology Corporation, better know for supplying long-range acoustic devices to the U.S. military for use in Iraq and New Orleans. For more technical information on how directional audio works, see http://www.holosonics.com/technology.html. Also see Marshall Sella, "The Sound of Things to Come," March 23, 2003, http://query.nytimes.com/gst/fullpage.html?res=9405E6D91731F930A15750C0A9659C8B63.

9. J. G. Ballard, "The Sound Sweep," in *The Voices of Time* (London: Orion, 1991), pp. 51–52.

10. On the unsound spectrum, silent discos can be contrasted to deaf discos that take place in clubs with sound systems that produce strong. low frequencies so that the music is inaudible to the dancers, but its subsonic rhythms are felt.

11. M. Fuller, *Media Ecologies* (Cambridge, Mass.: MIT Press, 2005), pp. 40–41.

12. A. Dunne, *Hertzian Tales: Electronic Products, Aesthetic Experience and Critical Design* (Cambridge, Mass.: MIT Press, 2005), p. 102.

13. Ibid., p. 105.

Chapter 34

1. We can find this strand of thought passing through the acoustic ecology movement, particularly Shaffer and Barry Truax, who both tend to idealize nature, through to Virilio's complaints against the "silencing of silence" through the sonification of art, through to Stuart Sim's frankly unhinged *Manifesto for Silence,* (Edinburgh: Edinburgh University Press, 2007).

2. The line passes from the Italian futurists' manifesto for noise in the Art of Noises through to Attali and recent texts by for example. It is interesting to note also that Cage stands at the crossroads of both the politics of noise and silence.

3. Michael Hardt and Antonio Negri, *Empire,* (Cambridge, Mass.: Harvard University Press, 2001).

4. Gilles Deleuze, "Postscript to Societies of Control," in *Negotiations,* trans. Martin Joughin (New York: Columbia University Press, 1995).

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